THE IRON TRADE REVIEW

VOLUME XXIX. CLEVELAND, O. AUGUST 27, 1896. CHICAGO, ILL. NUMBER 35.

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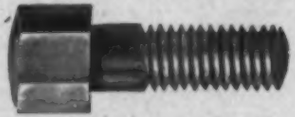

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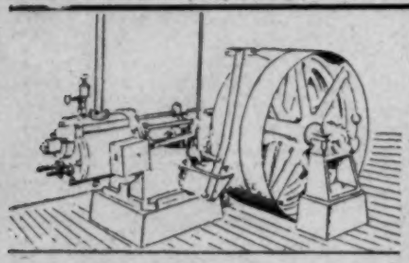

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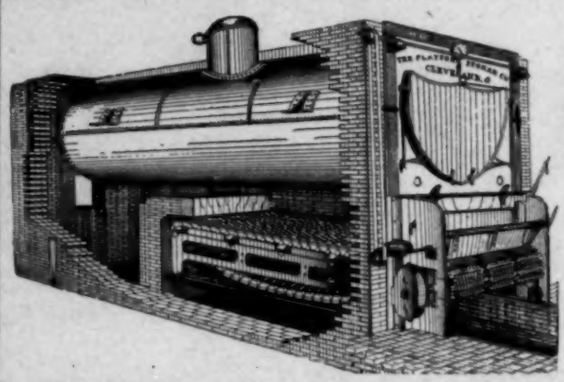

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THE IRON TRADE REVIEW

VOLUME XXIX. CLEVELAND, O. AUGUST 27, 1896. CHICAGO, ILL. NUMBER 35.

THE WEEK IN IRON CIRCLES.

THE MARKET AT LARGE.

A break in the monotony of the past two months has come in the shape of several deals in Southern iron. About 60,000 tons has been taken, but under circumstances that rather accent the hardships of the furnace interest, since the iron is to be transferred from furnace yards to warrant yards. The best feature about the transactions is that Alabama furnaces secure a large amount of money that will be very helpful in maintaining operations. But none of the iron goes into consumption, and whether it will remain only temporarily suspended over the market or whether it will become a speculative quantity to pass in the form of warrants from hand to hand for an indefinite time, does not yet appear. The basis of these deals is reported as from $6.25 to $6.40, Birmingham, for No. 2 foundry. In the same connection negotiations are reported for the taking of considerable lots of Southern iron by strong consumers in the East, but nothing has been closed. Money conditions prevent the entertaining of such propositions by the average buyer, and many sellers consider that pig iron is just as good to finance upon as the paper of customers, oftentimes better. We know of instances in which salesmen have been taken from the road and efforts confined to selling as little as possible, in view of the disturbed condition of credits. It would appear that the willingness to extend accommodation to the last degree consistent with safety is everywhere present, and the interdependence of the various departments of the trade is well appreciated. The failure of an Indiana steel company in the week is doubly conspicuous because the trade has thus far been quite free from open disaster. Bessemer ore, Bessemer pig iron and Bessemer steel seem to have reached the lowest degree of inactivity. Two Wheeling district sales of Bessemer pig are reported, one at $10.50 and the other at $10.85, Pittsburg. Sales are so exceptional, however, that prices have lost any significance. The next billet pool meeting is to be held at Cresson, Pa., in the coming week, and while no change in price is looked for, an adjustment of tonnage is likely to be made to meet the objections of steel works whose most finished product is billets. Mills east and west are run on about half time; in some instances the shut-downs last for a week. There has been some business in structural material the past week, Pittsburg getting most of it. B. & O. bridge requirements, some Chicago drainage canal tonnage, and a number of buildings in the East and in the Central West foot up quite a snug aggregate. A new pipe line in Indiana, which is to be built by Chicago capital, has brought a large order for wrought pipe to Pittsburg. Cast iron pipe works are quite slack and low bids have been made on recent municipal contracts. Another of the periodic revivals of the project for a cast iron pipe pool is on, but there is not much faith in a successful outcome. What threatened to be a long struggle in the leading Central Western tin plate works has ended in the signing of the scale, and the union wage basis is much more general in this industry than seemed likely two months ago. The foreign price has advanced slightly and there is a better chance of the continuance of the gentlemen's agreement among home manufacturers on Eastern deliveries.

THE CLEVELAND DISTRICT.

A few furnace companies whose requirements were not all met in early purchases have been taking moderate lots of ore in the last two weeks, chiefly non-Bessemer. Prices on the latter are found somewhat lower than at the opening of the season. More boats that have been in the ore trade are discharging their crews and going into ordinary. The difficulty of getting advances on ore is a prime factor, and in some instances vessel companies have received checks for a part of their freight money, the balance being settled in notes due at the close of the season. The condition of the docks below and the irregular operations by railroad and dock crews above make slow dispatch for boats, some of which are scarcely making expenses. The ore movement is expected to get steadily smaller from this time out. Furnacemen who have yet to cover will be supplied for the most part from stocks on dock.

Pig Iron. In connection with the recent purchases of Southern iron by warrant, it is stated that Eastern capital is ready to invest also in a block of Bessemer, say 20,000 tons, if it can be had at a price. Furnaces, however, are not willing to entertain any proposition that would be acceptable to such investors. We hear of no sales in the two valleys in the past week, and the quotation is nominal. Foundry iron can only be sold in 50-ton and 100-ton lots. Not even the strongest concerns will entertain a proposal to take large lots, no matter what the price. Such sales as are made are at lower figures this week, and quotations are reduced 25 to 50 cents. We hear of two lots of Southern forge sold in the valley at $9.60, equivalent to $5.60 at furnace, unless some concession was secured on freights. Northern forge has been offered at $9 in the valley, but the mills require a certain amount of Southern iron, even at the higher price. We quote, Cleveland delivery:

Bessemer	$11 50@11 75	Valley Scotch No. 1	$11 75
No. 1 Strong Foundry	11 75	Valley Scotch No. 2	11 25
No. 2 Strong Foundry	11 25	Gray Forge	9 50@10 00
No. 3 Foundry	10 25@10 50	Lake Superior Charcoal	13 50

Finished Material. Locally there is little business worth speaking of in any line of the products of the mills. In the valleys a week's operation is followed by a week's idleness and a fraction of the mill capacity, steadily operated, would take care of all the business. Collections are hard and strong concerns are no prompter in paying than the smaller ones. A small structural contract has been taken by a local concern, but there is nothing in prospect. A new university building at Columbus, the Reading subway work, at Philadelphia, and a Chicago drainage canal contract have attracted some attention. Steel bars are lower, and 1.10c, Cleveland, has been done. Other prices are stationary.

CHICAGO.

OFFICE OF *The Iron Trade Review*,
1142 MONADNOCK BLOCK, Aug 26.

Confidence in the success of sound money at the polls has increased considerably lately, and as a consequence buyers are a little more willing to consider the advisability of placing orders. In pig iron circles a little business was done last week in this market, and reports have been received of the sale of 60,000 tons of Southern pig iron to a New York syndicate which has made the purchase as a speculation. The opinion is expressed that it will encourage Southern furnace companies to ask for better prices than have been prevailing lately. In other branches, this market has been very quiet, and no sales of particular consequence have been made.

PIG IRON.—The week has been fully equal to the previous week in the point of sales, two or three orders for round lots having been closed. These include one contract for something over 2,000 tons, one for more than 1,000 tons and two or three of 500 tons each of Southern iron and one of 1,000 tons of Northern iron. Prices of Southern iron are a little lower than they were last week, and some of the sales made have been at figures a trifle under those we give. It is believed that the large sale made to Eastern speculators last week will have the effect of stiffening the market to some extent. Quotations of Northern iron are reduced 25 cents, and a good order for prompt shipment would enable the buyer to secure prices under our quotations. None of the furnaces, either Northern or Southern, seem to be anxious to take business for longer than two or three months delivery and very few sales for longer delivery are being made. Quotations are revised as follows:

Lake Sup. Charcoal	$13 50@14 00	Southern No. 2 Soft	$10 25@10 35
Local Coke Fdy. No. 1	11 50@11 75	South'n Silveries No. 1	11 35@11 85
Local Coke Fdy. No. 2	11 00@11 50	South'n Silveries No 2.	11 10@11 35
Local Coke Fdy. No. 3	10 50@11 00	Jackson Co. Silveries	14 00@16 00
Local Scotch Fdy. No. 1.	11 50@11 75	Ohio Silveries No. 1	15 00@15 50
Local Scotch Fdy. No. 2.	11 00@11 50	Ohio Silveries No. 2	14 50@15 00
Local Scotch Fdy. No. 3.	10 50@11 00	Ohio Strong Soften rs	14 00@14 25
South'n Coke No. 1	10 85@11 10	Alabama Car Wheel	16 25@16 75
South'n Coke No. 2	10 35@10 85	Malleable Bessemer	12 25@12 50
South'n Coke No. 3	10 10@10 35	Coke Bessemer	13 00@13 50
Southern No. 1 Soft	10 35@10 85		

BAR IRON.—The only news in this market is the leasing of the mill of the East Chicago Iron & Steel Co. by the Illinois Steel Co. The latter company does not expect to put this mill in operation immediately. Sales have been small and do not include any noteworthy orders. Quotations are made as follows: Common iron, 1.30c to 1.35c; guaranteed, 1.35c to 1.40c; soft steel bars from strctly billet stock, 1.25c to 1.30c.

RAILS AND TRACK SUPPLIES.—Small orders continue to be fairly plentiful but none of any size were placed last week. Following are prices: Rails, $29; splice bars, 1.35c to 1.45c track bolts with square nuts, 1.95c to 2c; hexagon nuts, 2.05c to 2.10c; spikes, 1.70c to 1.75c.

BILLETS AND RODS.—There are indications that there may be some buying in the near future, but up to the present time only a few very small sales have been made. Quotations on billets are unchanged at $21.25.

STRUCTURAL MATERIAL—The week was the dullest for some time. Very little business of any kind was done. The only thing new is an inquiry for from 700 to 800 tons of bridge material for work on the Drainage Canal. Quotations are lower as followes: Beams and channels, 1.70c to 1.75c; angles, 1.30c to 1.35c; plates, 1.35c to 1.40; tees, 1.50 to 1.55. Small lots from stock are quoted ¼c to ½c higher.

PLATES.—Almost no business was done last week and the outlook is not particularly bright for the immediate future. Quotations are revised as follows: Tank steel, 1.35c to 1.40c flange; steel, 1.55c to 1.60c fire-box steel, 2.15c to 5c.

SHEETS.—Only a few orders were closed, none of them of any size. The demand is very light and is not expected to be better immediately. Quotations are made at 2.15c to 2.20c for No. 27 black and 80 and 2½ to 80 and 5 per cent discount for galvanized.

MERCHANT STEEL.—The situation is not discouraging, as there are contracts for round lots in the market which are expected to be placed soon. General business is not especially good but was no worse than it has been for some time. Prices are as follows: Open-hearth spring, tire and machinery steel, 1.85c to 1.95c; smooth finished machinery steel, 1.60c to 1.65c; smooth finished tire, 1.55c to 1.65c; tool steel, 5.50c to 7.50c specials, 11c and upwards.

OLD RAILS AND WHEELS.—It is not likely that any trades of consequence will be closed in the present condition of the general market. A few hundred tons of old iron rails are reported to have sold at $11 last week. A sale is also reported of old steel rails at $6.55. These appear to be the only transactions upon which to base quotations. No business was done in old wheels, which are nominally quoted at $12.

SCRAP.—Stocks in dealers' hands are very large and are increasing all the time, as consumers are drawing upon them only in a very small way. Prices are weak and are only nominal. The following are buying quotations furnished by dealers: Railroad forge, $9 to $9.50; dealers' foge, $8.25 to $8.50; No. 1 mill, $6.50; heay cast, goss ton, $7.25 to $7.50; malleable cast, $7.75 to $8.25; axles, $12-25; cast borings, $3.25; wrought turnings, $3.75; axle turnings, $3.25; mixed steel, $6.25; stove plates, $5.25 heavy melting steel, $7.75 to $8.25.

PITTSBURG.

OFFICE OF *The Iron Trade Review*,
807 TRADESMEN'S BUILDING, Aug. 26.

There seems little prospect of a change in prevailing conditions before election. Until money gets easier little can be done. The greatest difficulty is experienced in making collections, even of accounts good without question in ordinary times. Nearly all that is doing in the pig iron market is due to financial conditions, sales being made to realize. The finished end has been somewhat more active. Sheet bars are in demand at pool prices. Two lots of billets, 500 tons each, have been sold at pool rates. An order for structural material aggregating 4,200 tons has been taken and a move in wrought pipe is noted. The meeting of the pool appointed for next Monday, it is announced, will be held in Cresson, Pa.

PIG IRON.—There have been in the week two sales of Bessemer of 2,000 tons each. In both cases the price was considerably below $11, Pittsburg, and it need not be added that the holder in each case desired to realize immediately. Sales of this sort are the only ones recorded, and fortunately they are rare. One lot of 500 tons of No. 2 foundry iron was sold by the resident agent of a Southern firm at a fair figure, but the transaction covered only the immediate necessities of the buyer. Gray forge is occasionally handled in small lots and presents a wide range of prices. Money is the key to the situation and little change is anticipated until the success of sound money is assured. Alabama warrant iron, in yards at Birmingham, has been put upon the local market at figures calculated to interest speculators. We continue to quote prices at which average stocks are held:

Bessemer	$11.50 to $12.00
No. 1 Foundry	11.75 to 12.00
No. 2 Foundry	11.25 to 11.50
Gray Forge	9.50 to 9.75

BILLETS.—Two sales of 500 tons each are reported at the pool price. Some cheap steel is still on the market and is held from $19.60 to $19.80, but cannot be disposed of at any price, not meeting buyers' specifications. Contrary to previous understanding the pool meeting next Monday will not be held in

Pittsburg. Any action at this time can have little effect on the present stagnation which is not concerned with prices.

STRUCTURAL MATERIAL.—Both local mills are again running full and report a slight improvement over the last few weeks. The large B. & O. order for bridge shapes went to the Schultz Bridge Co. The tonnage is given as 4,200 tons. The Peen Bridge Co. get the contract for trusses on the Government ordnance shop at its figure, $18,400. The structural shapes for the Roanoke, Va., station of the Norfolk & Western Ry. were taken by a Pittsburg mill. The bulk of orders come from the East and little work is in sight here. When necessary, prices go below the figures quoted below, but in general the market stands: Beams and channels, 1.55c; tees, 1.40c to 1.45c universal plates, 1.15c to 1.20c; angles, 1.15c to 1.20c; zees, 1.30 to 1.35c.

BARS.—Poduction has ceased almost entirely and the outlook shows few signs of encouragement. We continue our quotations: All much bar iron, 1.20c to 1.25c; common, 1.10c to 1.15c; Cleveland and Youngstown, 1.20c; steel bars, 1.10c to 1.15c.

PLATES.—There is no change to be noted. Deliveries on contracts occupy the mills but new business comes in small quantities. The following quotations have been shaded on close competition: Tank, 1.20c; shell, 1.30c to 1.35c; flange, 1.40c to 1.45c.

SHEETS.—Considerable business has been done of late in Sheets, although not in any large lots. Prices have been unsatisfactory and cutting has been the order. At present the situation is without feature. We quote No. 26, 1.95c to 2c; No. 27, 2.05c to 2.10c; No. 28, 2.10c to 2.15c.

WROUGHT PIPE.—Several good size dorders have been taken recently, the stocking-up period being at hand among dealers. The larger interests are said to be very eager for business and it is claimed are naming ridiculous figures. Otherwise five tens and 5 per cent is maintained. An order placed here for six-inch pipe for the new Cudahy oil line from northwestern Indiana to Chicago involves a large tonnage.

OLD MATERIAL.—There is no business in scrap. We continue quotations: Steel rails, $11 to $11.50; iron rails, $11.75; heavy melting stock, $11 to $11.50; No. 1 wrought scrap, $12, net; coil spring, $13; cast scrap, $10; hammered iron axles, $18 to $18.50; rolled iron axles, $16 to $16.50.

IN OTHER MARKETS.

[SPECIALLY REPORTED FOR THE IRON TRADE REVIEW.]

Cincinnati. In their review of the pig iron market, Rogers, Brown & Co. say: "It was stated last week that the pig iron market was in some respects better. It is a pleasure to say that although there has been no large buying by consumers, yet the reports received from all quarters indicate that the general feeling among business men is that the prospects for a sound money victory increase each day. There are a number of deals pending for lots ranging from 500 to 5,000 tons, and several speculative contracts have just been closed. One sale of 5,000 tons No. 2 foundry was made to a Cincinnati speculator, immediate delivery, spot cash. In the East there have been several trades aggregating about 50,000 tons. It is believed that the placing of blocks of ready money in the hands of Southern furnaces will serve to relieve their immediate necessities and enable them to become more independent. If confidence is restored to an extent that will cause the giving of ordinary contracts to foundries and rolling mills, there will shortly spring up a healthy buying movement for pig iron sufficient to take the current output of furnaces now in blast. Advices from Lake Superior coke furnaces in the Mahoning and Shenango valleys state that on account of furnaces being out of blast, stocks of pig iron are held for better prices. There is a limited demand for Lake Superior and Southern charcoal and Southern coke irons, principally for sorting up mixtures. Interest is mostly centered in Southern coke irons, because of the extremely low prices, and the ease and slight expense of carrying large lots for speculative purposes. It has been arranged so that storage receipts are issued and the iron carried for nominal charges. The storage receipts are first-class collateral, and can be readily used in banks. Collections are fairly good considering the stringency of the money market." Quotations on pig iron are made as follows. Most current transactions, however, are at private terms: Southern coke, No. 1 foundry, $9.50 to $10; No. 2, $9.25 to $9.50 No. 3, ; $9 to $9.25; gray forge, $8.65 to 8.75, mottled, $8.65 to $8.75; No. 1 soft, $9.25 to $9.50; No. 2 soft, $9 to $9.25; Lake Superior coke, No. 1, $12 to $12.50; Lake Superior coke, No. 2, $11.50 to $12; Hanging Rock charcoal, No. 1, $15.50 to $16.50; Tennessee charcoal, No. 1, $13 to $14; Jackson Co. silvery, No. 1, $13.50 to $14; standard Alabama car wheel, $14.75 to $15.50; Tennessee car wheel, $13.50 to $14.50 Lake Superior car wheel and malleable, $14.75 to $15.25. The market for finished marial continues quiet, with prices unchanged. We quote 1.30c to 1.35c for bar iron; 1.40c to 1.50c for plates and 2.25 for No. 27 sheet iron. There is such an accumulation of old material, with the mills well supplied on early contracts, that no betterment can come for some time. No. 1 railroad scrap is quoted $10.50 to $11; old iron rails, $12 to $12.50.

Buffalo. There is a lack, in this district, of the interest noticed for a week or two past, and business is confined largely to orders of the carload and 100-ton variety. The new orders entered and requests for delivery on old contracts are for quick shipment, indicating that conusmers are carrying unusually light stocks. Prices are a shade lower and the probabilities are that the prospect of a good sized order would bring out even lower figures than those mentioned below. No. 1 strong foundry lake ores, $12.50; No. 2, $12; Ohio strong softener, No. 1, $12.50; No. 2, $12; Jackson County silvery, No. 1, $15; Southern soft, No. 1, $11; No. 2, $10.75; Lake Superior charcoal, $13.50 to $14.

Philadelphia. The money situation has restricted operations on both sides of the market. Many who would be glad to take iron liberally on the present low prices will not incur large obligations in the present attitude of the banks; and, on the other hand, sellers find that their iron is easier to raise money on than the paper of customers. No large sales have been made here, but there are some negotiations going on by which some low priced lots may be taken off the market by large interests. Southern irons have been pressed for sale and some has been taken at 50c. below quoted prices. Nominal quotations are $12.50 to $12.75 for No. 1 X Foundry; $11.75 to $12 for No. 2 X and $10.75 to $11 for Southern gray forge. Southern irons at Harrisburg, Columbia, Baltimore and points taking like rates have been sold at 50 to 75 cents below the above. The billet market is as before—a few small lots taken at $20.75 for outside steel and at $21.50 from mills. A sale of basic blooms has been made for Eastern delivery at a very low price. With one or two exceptions rolling mills in this district are running on about half time. The business done is practically on a retail basis and quoted rates are generally secured. We quote plates at 1.35c to 1.40c; angles, 1.30c to 1.35c; bar iron, 1.20c to 1.25c; steel bars, 1.25c to 1.30c.

AT Ellwood City, Pa., the Ellwood Weldless Tube Works, employing over 400 men, have shut down indefinitely.

H. C. FRICK is home from Europe.

THE IRON TRADE REVIEW

DEVOTED TO IRON AND STEEL MANUFACTURE, FOUNDRY AND MACHINERY TRADES.

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GOOD TIMES ACROSS THE WATER.

It is not particularly cheering to the iron trade in the United States to contemplate at this time an unwonted activity in iron and steel among our European competitors. It is a fact, nevertheless, that the United Kingdom, Germany, France and Belgium have been outdoing their records of 1895, while on this side the turmoil over finance and the uncertain status of all business have quenched enterprise and reduced industrial operations within narrow limits. A few facts bearing on the situation abroad will be interesting, at least by way of temporary diversion from the troubles at home.

In pig iron output all the countries named made a gain in the first half of the year over their record for the first six months of 1895. In Great Britain the exact figure are not yet available, but it is estimated that about 4,000,000 gross tons of pig iron were produced to June 30 this year, against 3,721,870 gross tons in the first half of last year. Germany produced 3,095,805 tons to June 30, 1896, or at an annual rate of about 6,200,000 tons; in 1895 the year's product was 5,788,798 gross tons. France and Belgium, the former producing 2,005,889 metric tons in 1895 and the latter 829,135 tons, gained on this rate about 15 per cent in the first half of the present year.

All these countries report an increased export trade in iron and steel thus far in the present year. We have not at hand the figures for the Continental countries, but a statement just issued for Great Britain shows that in the seven months ending July 31 the exports of iron and steel were 1,999,211 tons, against 1,567,243 tons in the same period last year and 1,499,874 tons in the first seven months of 1894. An English contemporary, commenting on this showing, says:

> We find for the first seven months of the year an increase of about three millions sterling in iron and steel alone, which is really a notable advance, and sufficient to justify the claims made for a genuine revival of business. With such a difference in their favor for the current year, our iron and steel manufacturing concerns should show a very different result from that of some years past. It is pleasing to be able to add that the improvement is not limited to one section of the trade only, but to nearly all alike. It appears to be most marked in railroad *matériel*, galvanized sheets, unwrought steel, unenumerated iron and steel manufactures, but it is also, to a less extent, apparent in pig iron, wire, bar, angle, bolt and rod iron, and hoops, sheets and boiler plates.

Another index of the better conditions in England is the increase in wages. The report of the Government Board of Trade for the month ending July 15 says that 40,000 wage workers in that period obtained increases of their compensation, while only 3,000 suffered a decrease. The net result for all affected was an increase of 20 per cent. Among those getting an increase were 5,000 iron and steel workers, 18,000 mechanics in the engineering and shipbuilding industries, 9,000 workmen in other branches of the metal trades and 4,000 building operatives. The report further says that in most industries the state of employment continues very good, and that the percentage of unemployed in the various trade unions was but 3.2 per cent, as against 5.6 per cent for the same period last year.

August market reports in English iron trade papers say that prices are firm, that manufacturers generally have plenty of work, and that consumers find difficulty in obtaining deliveries, owing to pressure of work and accumulation of new specifications. Improved inquiry is noted on Indian and Colonial account, and Australasia and South America are making larger requisitions. It is stated also that "great activity continues to characterize Continental markets for iron and steel."

One reason for the activity of English works is to be found in the heavy requisitions of the new shipbuilding programme of the British Government. It is estimated that the five new battleships will require 48,200 tons of material, exclusive of machinery and equipment; the 13 armored cruisers, 30,000 tons, and the 28 torpedo boat destroyers, 10,800 tons. This makes an aggregate of 89,000 tons of material, altogether apart from engines, boilers and guns. It can readily be seen that plate mills, foundries and engineering works are thus guaranteed a business that, with the average of their home and export trade, readily accounts for the cheerful aspect of the iron and steel industry in the United Kingdom.

There is no doubt that large amounts of English capital that ordinarily would be available for the United States have been forced by the conditions prevailing on this side to seek investment at home, and lines have been developed which have given unusual prosperity and employment for capital and labor in Great Britain. Once persuade the owners of the accumulated millions still piled up in English vaults that the people of the United States will maintain their financial integrity and will continue to make every dollar of their currency as good as gold and pay their debts in the money of the world, and there would be no lack of capital for every legitimate American undertaking. The menace of cheap money and repudiation must be removed, deficient government revenues reinforced, and legislative discriminations against industry wiped out.

Then the United States may expect to have some share in the prosperity that is now visiting foreign shores.

Not only are our English cousins giving up the fight for the American tin plate market, but there is in the comments of their trade journals something more than a feeling of regret. The spirit that lurks in the last few lines of the following, from the *Iron and Coal Trades Review* is suggestive of regret that partakes of the querulous:

For the first seven months of 1896 we only shipped 73,552 tons of tin and terne plates to the United States, whereas in the first seven months of 1895 our shipments were 124,839 tons. The decline in our tin plate trade with the United States is therefore greater than the total decrease of our tin plate exports shown by a comparison of the two periods. Unfortunately, the decline does not appear to show any sign of recovery. It seems, in short, that our tin plate manufacturers have to accommodate themselves to the altered situation of affairs in their trade relations with the United States, but it would have been better for them had they taken steps long ago to develop their industry in other countries, as we have repeatedly urged them to do.

THE OUTLOOK FOR THE RAILROADS.

But for the continued heavy movement of grain through July, gross earnings for that month might have shown a decrease. As it is the rate of increase is but 4.02 per cent, as compared with the same month in the previous year. This is nearly the lowest percentage of increase reported for any month this year, and is considerably less than the June rate of increase, 8.29 per cent. The compilations of the *Financial Chronicle* give the earnings of 131 roads operating 97,357 miles, the total being $41,617,094, or $1,610,012 more than the earnings reported for a somewhat less mileage in July, 1895. The total of the month is about $7,000,000 more than in July, 1894, but in that month the railroad strike of Chicago brought about an almost complete suspension of traffic on a number of important roads; the earnings for July, 1896, were about the same as the July earnings in 1893, but that was the first and most severe year of the financial disturbance.

Nearly half the roads reporting show losses; and the earnings for the first weeks of August, as reported so far, show decreases on most roads, the Northwestern lines still being able to report increases. All these figures reflect the uncertain outlook for business, and apparently we must look for poor returns for some months at least. So that while earnings are not yet within five millions a month of the figure reported from years ago, the railroads are threatened with another heavy falling off.

The first important rate reductions of the year were made in July, one having a serious effect on earnings. This was the action of the Joint Traffic Association in reducing the corn rate from the Missouri River to the seaborad; the other instance was the rate war between the Seaboard Air Line and the Southern, which, at first confined to these two roads, at last threatened to involve all the Southern lines until summarily terminated by the power of the courts. The reduced corn rate has been successful in inducing a phenomenal movement. The receipts of corn at the Western primary markets were 13,608,000 bushels in July last, and were only a little over five million bushels in July, 1895. Wheat also continues to go forward in large quantities. Receipts at Western markets were over 17,000,000 bushels, as against 8,000,000 bushels in July, 1895, and so far this year have been over 78,000,000 bushels against 46,000,000 bushels for seven months in 1895. But this traffic, as in previous months, continues to chiefly benefit the spring wheat carrying roads, which have all had large gains.

Five of these lines report an aggregate increase of over $1,000,000 in earnings for the month. The Chicago, Milwaukee & St. Paul, the Great Northern and the Canadian Pacific have each gained more than $250,000; the Northern Pacific, $116,000, and the "Soo" road, $93,000. Other large increases are those of the Missouri Pacific, the Chicago, Rock Island & Pacific, the Illinois Central and the Norfolk & Western, each having a gain of over $100,000. The gains reported by the two last-named roads are explained by an increase in mileage by one company, and by comparison being made with the period of the coal miners' strike on the lines of the other. The Baltimore & Ohio also reports an increase of $148,000. The largest decreases are on roads in the South and in the Middle West. The "Big Four" has a loss of $96,000; the New York Central, $60,000; the Louisville & Nashville, $54,000, and the Southern, $92,000, on an increase of 155 miles of operated road.—[Railroad Gazette.

RAPID ADVANCE OF ELECTRIC POWER.

To gauge the progress in the use of electricity; attention should not be directed so much to the fields of electric lighting and electric railways as to that of electric power, a field which is now steadily repaying the arduous pioneering of the past few years. Scarcely a day now passes without the record of some extensive project for the transmission of power, or of the completion of some installation in which the current is used either to supersede steam, or in new places where steam would otherwise have been selected. Mills, mines, factories, machine shops of all kinds are steadily coming to the use of electric power. The economy and efficiency of electric power is perhaps most forcibly demonstrated by the extent of the orders place for power apparatus, for it may be confidently asserted that greater engineering talent and closer examination is brought to bear upon electric power apparatus than upon any apparatus of any other order.

The General Electric Co.'s power and mining department presents some figures which illustrate not only the growth in the use of electric power but also its economy and efficiency. These figures are represented in the unfluctuating horse power instead of in dollars; the latter would not afford a basis of comparison on account of the fluctuations in prices. The figures take in electric power apparatus only:

	1892.	1893.	1894.	1895.
Horse Power	13,719	18,702	42,379	46,729

In 1896 the missionary work of the previous four years has begun to tell. From January 1 to July 31 the total horse power of the apparatus amounted to over 48,000. In the same period in 1895 the aggregate orders amounted to 25,737 h. p. From Aug. 1 to Aug. 18 the total amount of power apparatus ordered during 1896 was increased to 62,164 h. p. Such a showing in face of the general dullness in business is remarkable, and perhaps emphasizes the fact that in hard times economy is sought through the use of apparatus which costs least to operate.

Proper Choice of Steel.

If steel manufacturers could in every case come into personal contact with their customers, and could always know the exact conditions under which a given bar of steel is to be used, there is no doubt, a writer observes, that this would result in a saving of many hundreds of pounds by steel users and in a much more satisfactory condition of affairs generally. An instance of this occurred the other day when a man entered the warehouse of a steel concern and proposed to buy a bar of steel from stock. In conversation with him it was brought out that he intended to use this steel for swaging dies —that is, dies for an operation similar to that which is performed in the Goodyear and Dayton swaging machines. He was informed that this bar of steel which he proposed to buy would probably make dies that would run in the machine an average of about eight hours each, whereas a bar of steel might be furnished him of the same quality and at the same price, but with its carbon adapted to the particular service required, which bar would make dies that would run an average of from eight to ten days on such work; and, of course, the proper steel was ordered. It cannot be too often impressed upon steel users that when they buy bars of steel in the open market they are buying steel which is usually adapted to the average or usual purpose for which bars of that shape and size are used, and that if tools are made of such a bar that are to be used for an entirely different purpose, then the chances are overwhelmingly against such tools being satisfactory.

THE CHIEF MACHINE SHOP PROBLEM.

In his article on "Newer Types of Metal-Cutting Machines," in the last issue of the *Engineering Magazine*, Horace L. Arnold puts well the situation that confronts the machine-shop that has average advantages but is not thoroughly modern in its tools. We quote from him:

"Supposing a machine shop, having its established line of work in demand, to be well ligted, floored, ventilated, capitalized, and suitably supplied with cranes and hoists, and generally so equipped as to avoid all needless losses in transportation and handling materials and work in progress, and supposing it to have a plant of metal-cutting tools bought ten or twelve years since, which are still in fair working condition, —what course is dictated by real economy?

"Each hour of labor should give the largest attainable result in finished product. Upon this axiom manager and superintendent are agreed. From this common base line, however, they travel in lines separated by a wide angle of divergence. The manager wants to use the old tools, while the superintendent wants to put the respectable, well preserved, antiquated money-eaters in the scrap-heap or the second-hand dealer's warerooms, and install the best he can buy or build in their place. The manager knows the old tools are good enough; the superintendent knows they are not worth shop-room as a gift, or even that they would not be worth taking as a gift with a yearly bonus of ten or twenty or thirty thousand dollars added.

"In this case, which is common enough, the wise superintendent will select the most general operation in the shop,—lathe work, boring, planing, drilling, or whatever it may be, —and quietly either alter an old tool to his mind, or buy one new tool of the greatest possible efficiency for that particular purpose; he will put an ambitious young man or cub on this tool, and tell him to show the old hands what he can do; he will double, treble, or quadruple his former per hour output. Cost cards will be compared by the manager, who will probably, if the superintendent shows a disposition to rest on his success, begin to urge the adoption of means to make like savings throughout the shops, although he would have previously opposed any change, and so the tool replacing is inaugurated.

"Suppose an engine lathe costs $500, and money is worth 5 per cent, and that the tool depreciates 10 per cent yearly, and so becomes valueless in ten years; suppose also that the yearly wage of the workman who runs this lathe is $500. The total cost of this lathe for its lifetime is $750, exclusive of driving power, belting, repairs, and shop-room, and the total cost of labor to run the lathe is $5,000. Suppose this lathe finishes 20 short shafts daily, two cuts over, ready for filing and polishing, with a single tool, finishing cut followed with the callipers, 300 days in the year, 60,000 shafts in its lifetime costing $5,750 ÷ 60,000 = $0,09416, or nearly 9½ cents each for lathe work. The management resolves to make better work for less money. The tool cost is $750, and labor cost is $5,000 for the life of the tool; obviously any great gain must be made by labor-saving, as the tool cost is small. The belt cone with four seps for a 2 inch belt is replaced by a two-step cone for a 4-inch belt, another tool post is added on the back side with an inverted tool, and a hollow-mill sizer is placed in this tool combination to follow the two tool cuts, so that one cut over finishes the same in half the time, and the workman does not need to follow the finishing cut with the callipers; as it takes but one minute to change pieces in the lathe, he has time to spare; he is offered the work at piece prices, and is willing to exert himself to increase his own earnings; four similar lathes are added, making a total of five, each finishing forty shafts per day, a total of 200 daily, 60,000 yearly, or 600,000 for the ten years' life of the plant; there is an added charge for tool-making and power and shop room, but these items make but a small aggregate; the management is liberal in its views, and permits the workman to double his pay and earn $1,000 yearly. Flooded lubrication of the work and the balanced cut of the two tools make the lathes last as long as before, though doing twice the work. The total cost for ten years is five lathes, $500 each, $2,500; interest, $1.250; labor, $10,000; total, $13,750 as the cost of finishing 600,000 shafts, or a little less than $2\frac{3}{10}$ cents per shaft, against the original cost of about 9½ cents, or a saving of, say, 7 cents on each piece = $42,000 total saving on 600,000 shafts, or a yearly saving of $4,200, while the workman's pay has been doubled. By the first conditions the yearly product was 6,000 shafts at a total cost of $575; with the improved plant 6,000 shafts cost $138.

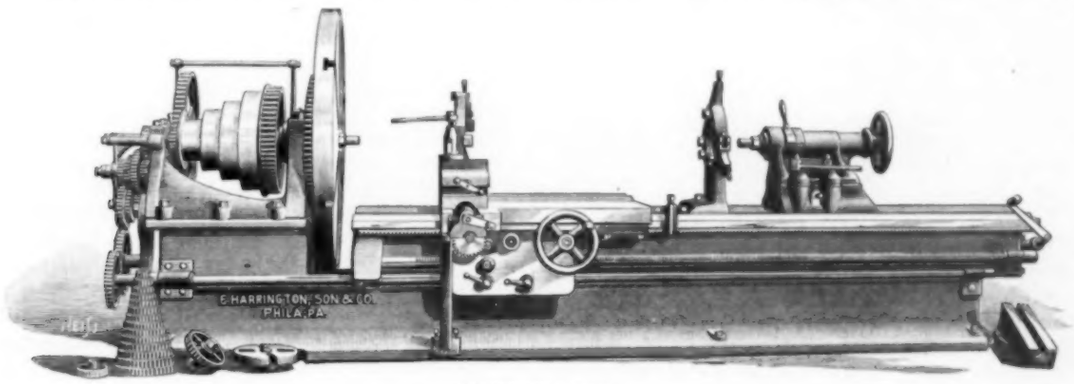
"This hypothetical case was almost exactly paralleled by the Mason Machine Shop with special lathes for finishing carding machine cylinders. I have not the exact figures, but believe the percentage of gain to have been greater in the real than in the supposed case, which is given because its simplicity makes it easily understood. First, the work must be wanted; next, driving power must be increased both in the office and the shop; finally, one man's labor must be made cover the use of more cutting edges. The work of each cutting tool edge may be increased vast beyond the practice of some shops. In other shops machine tools and labor conditions are such that each cutting tool is made to do all it can. Every agent of production has its limit of effect, and the most economical results are obtained from use well within the powers of the agent, whether the agent be a man, or a horse, or a driving belt, or the cutting edge of a metal-working tool. The best practice possible consists broadly in furnishing ample driving power, rigid tool support, multiple cutting edges, and in many cases, and possibly in all cases, flooded lubrication of cuts in progress. No experiments are recorded of the effect of lubrication on cuts in cast iron, which is still cut dry; until very lately, it was supposed that different metals required different lubricating materials, but the latest and best automatic screw-machine practice proves conclusively that flooded lard-oil lubrication is best for iron, steel, and wrought and cast brass, although brass is still worked dry in many and perhaps in the majority of cases. The best screw machine practice within my knowledge is that of the Lozier Cycle Shops, at Thompsonville, Conn., where the whole place is piped with the best lard oil from a single set of pumps, and all cuts of every description are flooded with this single lubricant. Forced lubrication is indispensable in some cases, and a most important aid to economical production in all cases, high pressures of 200 pounds to the inch or more being essential to the best production of some cuts. Water, soda-water, and soap and water, can be used to great advantage on heavy work, but it is not in heavy work that enormous savings in finishing and cost can be made, although it is highly probable that steam-engine finishing now costs but little more than half, or possibly but little more than a third, what it did ten years ago. Seven thousand horse power of Corliss engines was lately contracted at 3½ cents per pound, which indicates recent great reductions in labor on work of this class. The modern large boring mill, with two or three cutting tools in simultaneous operation, greatly cheapens the cost of a large class of work. The iron planer has had its effectiveness increased in two ways,—by increasing the number of tools, and the length of the bed, so as to permit the placing of many short pieces at once. In some cases twelve or eighteen planer tools are in simultaneous cut on one planer; in other cases, one man attends several planers; in other cases, the piece-worker abandons the use of automatic feeds of uniform width, and feeds the tools by hand for roughing larger work. At the Baldwin shop locomotive frames are planed two at a time, on special Sellers planers, at an increadibly low cost. At the Hendey Norton Lathe Shops, Torrington, Conn , a six-foot engine lathe bed is sometimes planed for less than one dollar, on a special long table machine, with several tool-carrying heads. Lack of space forbids particulars, no matter how interesting or pertinent. I can do no more than simply assert the bare outlines of most advanced practice; the lowest-cost work is being constantly cheapened, and the factors of cost reduction are rigid tool support, abundant driving power, multiple cutting edges, and forced lubrication. These things are perfectly recognized and fully understood by some managers and superintendents of to-day, and machine-tool makers are being gradually forced to meet the requirements of such buyers. I use the word 'forced' advisedly. The good and successful machine-tool builder must follow the public demand. He cannot create it, and cannot hurry it.

"As for the users of old tools, the managers who proudly cherish and tenderly preserve a museum of machine-tool antiquities, nothing can improve their condition short of a sheriff's sale. Such shops may earn a living at repairs and foundry

jobbing by carefully pottering along in the old tracks with a constantly diminishing force of gray-haired and spectacled old-time machinists, standing to day where ther feet wore holes in the floor twenty or thirty years ago; or they may close the doors over their grass-grown thresholds in silent confession that they are distanced in the race. There are hundreds of such shops in the country, and there is but one fate for all of them. They must change or quit. And it is not enough to put in here and there a new tool among the hoary wrecks which they dignify by the name of 'tools," as in a case which I saw very recently, where a large Gisholt turret chucking machine stood at one end of the machine floor and a Cincinnati Milling Machine Co.'s milling machine and cutter grinder at the other end, and nothing of later date than 1870 between them. 'Times are not what they used to be,' said the old man in the neglected office; 'business is dull.' "

EXTENSION LATHE.

A lathe designed especially for use in repair or jobbing shops, and so constructed that the gap may be made wide or narrow to suit the work, is manufactured by Edwin Harrington, Son & Co., of Philadelphia. The extension arrangement also allows the turning of a much longer shaft, as the distance between centers may be doubled by the extension of the top portion of the bed. The swing is 28 inches over top shears, 21 inches over the carriage and 48 inches over the lower guides through the gap. The cone has four sections and 3½-inch face, with back gearing and geared face place. Extra tool block or turning pulleys are 48 inches in diameter. The top



EXTENSION LATHE.

slides are fitted to the lower guides, to be drawn back by means of the hand wheel and screw at the rear end. The overhang of the carriage for turning the full swing of the lathe is rigidly supported by an angle or bracket having an adjustable shoe on the guide on the bottom of the bed. This gives firm support, permitting of a heavy cut when turning 48 inches diameter.

The carriage has long bearings which are self-oiling, decreasing the liability to wear the guides when used on short work. Forged steel spindles are provided and bronze metal boxes. Morse standard taper is used in lathe and drill press spindles. A hand movement of the carriage is secured by means of a hand wheel and pinion engaging in a steel rack on the bed. The steel rack is put on in sections, enabling repair of broken cogs by supplying a new section. Independent geared friction feed, cross feed, and reverse feed motions are secured in the apron attached to the carriage. Turning and screw cutting feeds cannot become engaged at the same time. The lead screw on front of lathe is made of steel, and is clamped by open and shut nut; screw threads are only used when cutting screws. All gearing is cut. All smaller pinions are of steel.

Milling Machine Practice.

The milling machine is most sensitive to the faintest tremble in the work, the machine or the cutter, and slight vibrations make chatter marks, which spoil the work. The depth of cut which the cutting edge or tooth of the milling cutter will stand is much less than might be looked for; it varies, according to the circumstances, from less than a tissue paper thickness to that of three or four newspaper (0.001 inch to 0 015 inch). Anything in excess of this destroys the cutter rapidly. It will be clear that with such thin shavings very faint vibrations show at once by uneven cuts. In addition, while the forces and resistances are constant with the single tool, they change every instant with the rotary cutter. Therefore, not only,on the one hand, does the milling cutter action tend to bring about vibration, but the result of such vibration is bad work.

It follows from these working conditions that the design and fitting of the milling machine must allow the least possible vibration or deflection, either in the work table or in the cutter spindle, and that, if the product is to be smooth and accurate, the construction of the machine must be also of the most accurate and substantial kind. In fact there is no other machine tool which exacts the same minutely careful design or high grade of workmanship. There is little or no fine fitting and scraping in very many of the cheap lathes, planers and shapers which, for common work, give perfect satisfaction. The very beautiful, almost mathematically accurate, product of the milling machine is the fruit of the untiring labor of the highly skilled tool makers, who designed and built the machine and its fixtures, and who must continue to watch over them, to see that they are kept in perfect order.

Not only is the first cost of the milling machine higher than that of other tools of like capacity, but also the cost of the cutters must be considered. Although the marked advance in cutter making has lessened their price in recent years, cutters of unusual size or shape remain very expensive. —[Cassier's Magazine.

THE September *Scribner's* publishes the first adequate account of "The New Olympian Games" at Athens, of which the cable gave a brief story at the time. Prof. Rufus B. Richardson, director of the American School at Athens, who had every advantage of seeing the games under favorable auspices, has written the *Scribner* article, which is full of enthusiasm and graphic narrative. The illustrations are abundant and attractive. Two outdoor articles are also features of the number, which is an unusually strong one. In the September *Lippincott's* the complete novel is "A Marital Liability," by Elizabeth Phipps Train. One of the noteworthy contributions is "The Natural History of Fiatism," by Fred Perry Powers; and in it the opinions of the free silver advocates are handled without gloves. "The Life of a Medical Student," by Dr. A. L. Benedict; "Advantages of International Exhibitions," by Theodore Stanton, and "How to Conduct a Local Newspaper," by the late John A. Cockerill, are among other articles.

THE Connellsville *Courier* estimates the production of coke in that region at 72,620 tons in the week ending Aug. 15, a decline of 10,000 tons from the preceding week. In Juy the weekly rate was about 100,000 tons. Shipments in the week mentioned were 4,392 cars, a falling off of 167 cars. The list of idle ovens is now considerably larger than the active list.

WORD received by a well-known Eastern iron and steel house from its English correspondents thus emphasizes the contrast between conditions at home and abroad: "Here all our works are in full employment and most of our rail mills full for three to six months; in fact the demand for all descriptions of iron and steel is greater than for many years past. Belgian and Continental works are fuller still, and many of them are sold up to the end of year."

LAKE SUPERIOR MINING INSTITUTE.

Having held its 1895 meeting on the Mesabi, the youngest of the upper lake iron ranges, the Lake Superior Mining Institute went this year for its discussions and inspection tours to the parent range, the Marquette, with its famous mines, its time-tried methods and its strong and well-managed companies. Ishpeming, Mich., was the gathering point, and in the early afternoon of Tuesday, Aug. 18, the tour was taken up of the well-known properties that have built it up into what is probably the staunchest mining town in the Lake Superior region. The attendance was good, though the outside ranges were not so largely represented as was the case at the Mesabi meeting last year. The following were among those who were present throughout the meeting, or who joined in some particular excursion: Geo. A. Newett, W. H. Johnston, E. F. Bradt, C. E. Hendrick, B. E. La Londe, C. T. Mixer, W. H. Anderson, F. J. Baker, F. W. Nelson, J. M. Vickers, John H. Quinn, Fred E. Vickers, A. E. Buzzo, J. E. Jopling, W. H. Nelson, Thos. Buzzo, James Clancy, A. J. Youngbluth, C. T. Fairbairn, C. H. Hall, J. C. W. Chipman, Ishpeming; D. T. Morgan, P. M. Pascoe, Republic; Austin Farrell, Thos. H. Noble, Gladstone; E. V. Palmer, Denver, Col.; A. O. Jopling, Peter White, S. H. Holley, Marquette; W. J. Olcott, Geo. D. Swift, L. J. Merritt, Duluth; J. F. Armstrong, Hibbing, Minn.; Graham Pope, Frank McM. Stanton, H. W. Fesing, Houghton, Mich.; Chas. W. Hughes, Amasa, Mich.; W. G. Mather, L. B. Miller, A. I. Findley, Cleveland; Geo. H. Abeel, Hurley, Wis.; J. C. Kirkpatrick T. F. Cole, Samuel Mitchell, Thos. M. Wells, Thos. Pellow, James H. Rough, Negaunee; Walter Fitch, Champion; Per Larsson, Norway; Wm. Kelly, Vulcan; W. S. Bayley, U. S. Geological Survey, Waterville, Me.; S. H. Pitkin, Webster, Camp & Lane Machine Co., Akron, O.; L. G. Kaufman, Hiram A. Burt, Marquette; W. E. Dickinson, Florence, Wis.; Dunbar D. Scott, Iron Belt; I. W. Truettner, Bessemer, Mich.; Nelson P. Hulst, W. D. Van Dyke, H. T. Hulst, Milwaukee; J. Page Laughlin, Pittsburg; John Heebner, Philadelphia; F. W. Denton, Minneapolis; James Ames, J. H. Karkeer. Many did not register.

The properties visited were the Cleveland Lake Shaft and the Salisbury mines, of the Cleveland-Cliffs Iron Co.; the Lake Shaft and Section 16 mines, of the Lake Superior Iron Co., and the East End mine of the Pittsburg & Lake Angeline Iron Co. All three companies are now conducting a part of their mining operations under the old bottom of Lake Angeline, the waters of whch, to the amount of 800,000,000 gallons were pumped out about four years ago. There is a plentiful growth of vegetation from out of the mud that still remains, but beneath, the mass is so mobile and so watery that mining work is carried on with extreme caution. Time does not seem to dry up this mud, which is from 15 to 40 feet in depth. The first level of the Cleveland Lake mine is at a depth of 150 feet, leaving a good thickness of ore as protection against the treacherous deposit above. At the northwest portion of the Lake mine some work is prosecuted on the caving plan, where the ore is 115 feet thick. The surface has settled evenly and thus far the mud has been kept out of the mine. In the power house of the Cleveland Lake mine the party inspected a direct-acting hoisting plant that has proved exceptionally efficient. In the boiler room were seen four Jones mechanical stokers, which yield an economy in firing and permit of using slack costing 20 cents a ton less than the steam coal usually burned. On the east side of the old lake the outcrop of the Cleveland Lake deposit has been mined by the open pit plan, and this working was inspected also. After the surface is stripped the ore is milled down to the first level, and thence conveyed by electric haulage to the Lake shaft.

The Salisbury mine and the problem presented by the settling of the surface especially interested the visitors. A new engine house site was chosen two or three years ago because the old building was endangered by the sinking of the ground. But evidences of a breaking away from the rock that rises abruptly beside the new engine house are apparent, and it has been necessary to take special precautions to prevent the loss of the shaft. The location of a new shaft is a problem that will soon press for a solution.

Surface inspections, which were all that the programme contemplated at any of the properties visited in the course of the meeting, were next made at the Lake Superior Lake Shaft and the Section 16 mine. With nearly 6¼ million tons of ore shipped in the past 37 years and abundant resources accumulated in the days of good prices for ore, the Lake Superior company has been in position to follow a progressive policy and to develop its property and make extensions on broad lines. Some distance south of the Lake Shaft new work is going on, and a deposit of excellent Bessemer ore has been reached which will be raised through the Lake Shaft. The compressor plant of the company is a notable one and attracted not a little attention. The Section 21 mine, which is some distance outside the city bounds, was not visited. A considerable expenditure has been made here in preparatory work and the deposit is known to be large, justifying a liberal expenditure for modern hoisting, compressor and pumping outfits.

The electric haulage equipment at the Lake Angeline East End mine was the feature of this famous property that elicited special inquiry. The electric motor draws 10 two-ton cars, power being provided by an 85 h. p. dynamo. The first level, on which the electric haulage plant was first installed, has been practically worked out, the caving system being employed, and early in the present season tracks were laid on the second level and the traction is now through that level, the plan being to work from the top down, in mining the ore. The cost of tramming has been considerably reduced by the electric plant, some figures being given at the evening meeting of the Institute. At the Lake Angeline the dry or change house was found to be exceptional in its proportions and conveniences.

The last visit of the afternoon was to the Excelsior furnace, a charcoal stack that has developed surprising efficiency under the management of W. H. Nelson. With the building of a new stove and the installation of a new engine, the output has been brought up to 2200 tons a month, some days going as high as 80 tons, as against 20 tons a day in its earlier operations. The party arrived in time to see a cast.

The evening meeting of the Institute was held in the Ishpeming Opera House. Vice-president Per Larsson, of Norway, presided in the absence of President John Duncan, of Calumet. A letter was read from John Birkinbine regretting his inability to accept the secretary's invitation to attend. He referred to the evolution in Lake Superior iron mining, particularly in the matter of costs, noting the fact that many mines were selling ore to-day, and making a profit, at a figure that in earlier years would not have covered the single item of getting the ore out of the ground.

Methods of Sampling Iron Ore.

The following paper was read by Mr. C. T. Mixer, of Mixer & Dubois, Ishpeming, Mich. It was very generally commended for its comprehensive and thorough-going handling of the subject:

Mr. Brown's excellent paper on the "Distribution of Phosphorus and System of Sampling at the Pewabic Mine," read at the last meeting of the Institute, proved of such interest, and provoked so much discussion, that our secretary thought a similar paper in connection with some of our Marquette County mines, might also prove interesting, and be at least useful for reference in the proceedings of the Institute. I will accordingly endeavor to present to you briefly the schemes that are adopted at some of our prominent mines to separate properly their various ores, and will include a few remarks upon the occurrence of the iron and phosphorus in some of the deposits.

Pittsburg & Lake Angeline Iron Co.—The Lake Angeline Co. adopts the plan of sampling each stope every other day, alternating between the East End mine and the old mine. A special man is detailed for this work, and it is also his duty to properly describe the places he samples, and call the mining engineer's attention to anything unusual in connection with the taking of the sample. He uses his discretion as to whether to take from the breast or the broken ore. Each sample is sufficient in amount to fill a small saucer, in which it is dried during the night, is ground the next morning, and the results obtained from the laboratory in the afternoon. Results can be judged by the eye at noontime, and any changes made if necessary. Still, it is not usual to condemn a place upon one sampling, unless the character of the ore

has already been apparently changing, or has come from a bad locality.

In the East End mine, south deposit, for a distance of say 100 feet west and 200 feet east of the main cross cut, the phosphorus is found to be very high right under the silicious capping, but on coming down to the first level, the character changes, so that all the east side becomes Bessemer, and a small portion of the west side also. In the extreme east end of the mine, the upper portions were put out for firstclass, since the non-Bessemer zone was in too small quantity to separate easily.

When the bottom of the basin is reached, the phosphorus increases to perhaps 5 per cent, which indicates that the phosphorus has been reached from the upper portions and concentrated in the trough.

In the north deposit, west of the main cross cut, the ore is all within the Bessemer limit, running about .020 in phosphorus, but also increases in amount, as it approaches the trough. In the south deposit, 300 feet west of the main cross cut, the phosphorus is extremely irregular, and if this ore were mined alone would scarcely be Bessemer. As it is, nearly one-half is separated as Bessemer. In the whole mine about 80 per cent is secured within the Bessemer limit of .045.

In the old mine the phosphorus is quite regular, ranging from .007 to .035. The ore, much of which is of the hard variety, is mainly classified with regard to the iron content. Two grades are made, the first known as No. 1 hard, containing about 66 per cent of iron and .015 in phosphorus, and the second, called Sheffield, containing 61 per cent in iron and .030 phosphorus.

After the ore from these mines is hoisted, car samples are taken, varying in number cacording to the size of the cars, and no further samples are taken until the ore reaches its destination. Last year samples were also taken at the shipping port, but these have since been discontinued as being an unnecessary expense and trouble. During the winter season a sample is taken of each grade of ore from each skip hoisted, and these are combined into weekly samples for analysis. A daily stockpile sample is also taken and made into a weekly sample. This system of sampling has always proved entirely satisfactory, and at the end of the season the average results of cargo analyses have always checked closely with the mine figures.

Cleveland Cliffs Iron Co.—At the Cleveland Lake mine the practice is adopted of sampling each stope every day, and when drifting sampling every ten feet. Chute samples are also taken, sometimes representing two or three different contracts, and the results from these are mainly relied upon in determining the make-up of the various grades. Of these grades there are at present seven, with the following general limits:

Bessemer No. 1	Iron	66.00	Phos.	.030
Bessemer No. 2	"	63.00	"	.040
East End	"	60.00	"	.050
Lake	"	60.00	"	.080-.100
Ishpeming	"	57-55%	"	.065-.070
Silica	"	47.00	"	.045
Silica	"	47.00	"	.030

The ore for each of these grades is then sampled at the surface and is kept for a daily sample, unless some special grade is called for. In case any emergencies arise the railroad cars are also sampled, and when shipping from stockpile the cars are always sampled. The ore is next sampled at the shipping port, as it is being loaded into the vessel, and the sample returned to the mine for analysis.

The underground samples are generally in the crusher room by 6 a.m., and the results are obtained from the laboratory by 2 or 3 p.m. This enables any changes to be made that evening, if necessary. The car samples are brought in at night, and dry over night, the results being obtained the next afternoon.

During the past spring a new scheme in the form of a daily chart, having columns for recording the daily analyses of stopes, outputs and grades, was tried, it being thought that it would aid in systematizing the grading, and show at a glance what could be and was being accomplished with the material at hand. After a few weeks the system had to be abandoned, for several reasons. The averages of the stopes and drifts did not always agree with the samples taken by the skiptender, there sometimes being great discrepancies. This was partly due to the fact that ore that was sampled and broken in drifting might or might not go up the day reported. This, of course, had to be at the discretion of the mining captain, who might have to change the place of working of a party, depending on conditions that might arise, such as caving ground, need of repairs, absence of full force, etc.

In fact, the grading of the ore had to be almost entirely a matter of personal attention of the captain and his clerk, who must be familiar with results taken from every part of the mine, and change men about whenever thought best to make the necessary grades. It was found difficult to know how to obtain such mixtures, unless constantly on the ground, nor could maps embrace the irregular stopes and raises by any convenient plans and cross sections.

With regard to the open pit, where the ore is milled to the first level of the mine, chute samples are generally the most relied upon, though special samples are sometimes taken.

The class of ore in the various localities of the pit having been ascertained, men can be sent at any time to certain places, and take out whatever grade of ore is required to mix with the grades being made.

At the Salisbury mine of the Cleveland Cliffs Co., where three or four grades of ore are made, the most reliance is put upon the skip samples, and when anything runs unusual, special stope samples are taken. The railroad cars are also samples, as well as the cargoes at the shipping port. These samples generally check very closely with each other, and are consdered very satisfactory.

Lake Superior Iron Co.—At the Lake Superior Co.'s mines the stopes are generally sampled three times a week. Samples are usually taken by the shift-bosses in the forenoon, dried and ground in the afternoon, and the results are obtained from the laboratory by the next noon. In the regular grades of ore a daily sample is taken from the cars, which in special cases may be cut up into samples representing 10 to 40 cars. From the stockpiles 20 to 30 cars make up a sample. These samples are sent in at night, and worked at convenience.

During the winter daily stockpile samples are taken and combined into a weekly sample for analysis.

In the Lake shaft of the Lake Superior Co. there is a body of ore which is interesting, to the chemist at least, on account of the unusual amount of insoluble phosphorus which is present. A year ago an attempt was made to keep a daily record of the insoluble phosphorus in each stope separately, to see if there was not uniformity enough in it to warrant the addition of a constant quantity to the soluble phosphorus result. Although the main object was not attained, the results were so interesting that they were obtained for this paper On the first, or 320-foot level, the insoluble phosphorus ranged from .002 to .031, giving an average of .007, the soluble being .051. On the 380-foot level the insoluble phosphorus ranged from .006 to .185, giving an average of .033, the soluble being .047. On the 444-foot level the insoluble ranged from .006 to .132, giving an average insoluble of .044 and soluble .051. On the 514-foot level the insoluble ranged from .006 to .078, average .023, and soluble .125.

Thus the irregularity of the ore, and the added inconvenience of hig hinsoluble phosphorus prevented the separation into a Bessemer grade, though the ore from the upper levels was put out for a .070 grade.

From all its mines the Lake Superior Co. makes a total of 13 grades of ore, six of which would be considered Bessemer and seven non-Bessemer, and they consider their system of sampling to be sufficiently accurate to accomplish the necessary separations.

Cambria and Lillie.—At the Cambria mine it is only found necessary to sample the stopes about every other day, and the next sample is taken from the cars, it being the rule not to exceed ten cars to the sample, whether taken from stockpile or pocket. At the Lillie mine each stope is sampled every day. Daily skip samples of each of the two grades of ore are also taken, as follows:

A man is stationed where the tram cars dump into the skip, and it is his business to take the contract tag and a handful of ore from each car, and place the tag on a hook over the box that has that contract mentioned on its board, and put the ore in the box. There being but two grades of ore, and consequently but two boxes, and their appropriate tags, any error in taking the samples can be easily checked up at the end of each 24 hours.

In practice, the results from these daily skip samples are found to agree closely with those from the railroad cars, which latter include only 10 cars to the sample, as in the case of the Cambria ore. An additional check upon the above work is sometimes made by also taking cargo samples at the shipping port.

Negaunee Mining Co.—In the Negaunee mine one man does all the sampling underground. It is so arranged that each crew has two places to work in, mining from one place while the other is being sampled and analyzed, and vice versa. In this way the underground results can be of much more service, and the outputs kept more uniform. Every tram car of Bessemer ore is then sampled and put into the daily output sample. Railroad car samples are also taken, varying in number of cars to the sample from 10 to 40.

During the winter the stock pile is sampled three times a day, and the samples combined into a daily sample.

In looking over the comparative averages of their Bessemer sampling for the past month, we find an extreme difference of .3 per cent in iron and .004 per cent in phosphorus between the stope samples, tram car and railroad car samples, which plainly shows the efficiency of the method adopted.

Queen mine.—Here, as at the Negaunee mine, it is sometimes customary to work the crews in two places, so that the broken ore can be sampled and analyzed before being hoisted. Where the phosphorus cuts a figure the stopes are sampled every day. If they are taken in the morning, the results are obtained the same day. Daily skip samples of each of the seven or eight grades of ore are taken and no further sampling is attempted.

Champion Iron Co.—At the Champion mine but little sampling is required. The stopes are rarely sampled unless some irregularity is noticed in the output. Tape line samples of the railroad cars are taken, and combined into a daily sample of each of the three grades. The stockpile is also sampled daily.

Underground Electric Haulage at Cleveland Lake Mine.

An interesting paper was read by J. E. Jopling, mining engineer of the Cleveland Cliffs Co., on the electric haulage plant at the Cleveland Lake mine. We give it in full:

The electric haulage plant in the Lake mine was installed during the years 1893-94, while Mr. Frank P. Mills was agent of the company. Explorations under the bed of Lake Angeline, which has since been drained, had proved that upon the first level the length of ore in what is known as the "Lake" deposit was over 2,400 feet, and that the distance from the foot-wall of the north vein to the foot-wall of the south vein of the basin was over 600 feet, measured at its widest. As arrangements had been made to take all this ore through No. 1 shaft, it was evident that a haulage plant of some kind was necessary. In January, 1893, Mr. Samuel Parnall, the mining engineer, accompanied by Capt. James Reed, inspected several such plants in the coal regions of Pennsylvania and Ohio. As a result of investigations a trial was made the same year with an electric haulage plant consisting of a small generator and the motor which is still running on the second level. It was not until 1894 that the plant was completed in its present shape, the electrical equipment being furnished by the General Electric Co.

The generating machinery is installed in the engine house, in which is the hoisting plant described at a former meeting of the Institute. The engine is a 16 x 42-inch Corliss of 115 h. p., at 95 pounds steam pressure, though at present 120 pounds are used. It has separate wrist plates and eccentrics for admission and exhaust valves. It is run at 82 revolutions per minute and is connected direct to a 15-foot drive wheel with 24-inch face. A double leather belt connects the generator, which has an 18-inch pulley. The generator is a direct current machine of the multipolar type and runs at 650 revolutions, giving an electro-motive force of 220 volts without load and is over-compounded for 240 volts at full load. Its capacity is 420 amperes. A blast of air from the compressor is used to keep the bearings cool. On the switchboard is a circuit breaker which is set to automatically open the circuit when the current reaches 300 amperes. There are also a lightning arrester and the usual voltmeter and ammeter, while the switches are so arranged as to entirely cut off the current from the mine or from either level by itself. The engine and boiler houses and dry house are all lighted from the same machine, the lamp being 16 c. p. 220 volts. These are connected so as to give light even if the current is for any reason cut off from the mine. The two main wires leading down the shaft are No. 0 copper, one for each level, and are encased in rubber inside a lead tube, which is again covered with asphalt paint. They are protected by being placed against the back of the shaft in a plank grooved to receive them, another plank being spiked on to hold them in place. The return is a No. 0 0 bare tinned copper wire fastened to the side of the shaft.

On the levels the trolley wires are supported by insulators of the regular mining pattern at a height of about six feet six inches above the rails. These insulators are fastened to the under side of a two-inch plank, which is spiked to the caps of the drift over the center of the track. At intervals a branch copper wire of No. 12 gauge leads to a 220-volt 16 c. p. lamp which is connected with the return. There are about 100 of these lights at different points along the track, using a current of about 15 amperes. The return upon both the levels is also a No. 0 0 tinned copper wire, and is connected with the rail bonds in the usual manner. The rails on the motor tracks are 40 pounds to the yard and the ties six inches by six inches by four feet long. The gauge is two feet six inches. It was designed to make a complete circuit on each of the first and second levels, consequently there is little or no grade, except where the track has been extended south on the second level to the so-called Lake Angeline deposit, which is the same vein as in the Pittsburgh & Lake Angeline Iron Co.'s East End mine. Here the grade is less than one per cent. The minimum curve has 42-foot radius.

The motor on the first level is a 65 h. p. machine, upon four 24-inch wheels, which are of cast iron with steel tires shrunk upon them. Both are geared to one armature of the gramme ring type. The wheel base is 3 feet 6 inches and the size over all is 11 feet by 4 feet 2 inches. The weight of the motor has been reduced from 11 to nine tons, and the speed is six miles an hour, with a train load of 50 tons. The trolley pole is 3 feet long and the wheel is swiveled to adjust itself to the curves. There is a headlight of two incandescent lamps. The drawhead is of wrought iron and the brake, which is operated by hand, is of the toggle pattern, similar to a steam brake in a locomotive. The 20 tram cars on this level are of iron and stand 4 feet 3 inches above the track, by 11 feet long over all. The hopper is 3 feet 10 inches by 7 feet 2 inches at the top and 4 feet by 2 feet 10 inches at the bottom and holds about three tons of hematite ore. The door at the bottom is hinged at one end and drops when the catch is released, again closing automatically as the car is pulled over a roller set between the tracks, by which the door is raised into place. The wheels are loose upon the axles, have a babbitt bushing, and are self-oiling.

The motor on the second level is smaller and of higher speed, running 10 miles an hour with a 25-ton train load. It is a 30 h. p. machine, having four 30-inch wheels, with an armature geared 5 to 18 on either axle. Its weight has been increased from four to seven tons. The wheels are ordinary car wheels and have lasted two years, or the same as those described on the first level motor. The wheel base is four feet and the motor occupies a space of 11 feet by 4 feet 2 inches over all. The trolley has an electric light attached. The brake is of the ordinary street car pattern.

The cars on this level are of iron, though the frames are stiffened with wood and the wheels are of the ordinary railway car pattern. The cars which are, of course, filled from chutes, are dumped into pocket above the skip, holding a single load, and the ore is released from the pocket by a door sliding at the same inclination as the shaft. No gates are used for the skips which run in balance.

It might be of interest to say that checks numbered to denote the grade of ore are attached to the cars by the chute men, while an indicator, worked by a rope, is set where the ore is hoisted to show in the shaft house what grade is coming up.

The delays due to repairs of course vary considerably. An extra armature and rheostat are kept on hand for each motor, so that little time is lost from burn-outs, changes being made, when possible, out of working hours. The only burn-outs on the large motor have been in the rheostat, and the switch has been out of order once. The small motor has caused more trouble, the armatures having been burned out several times

when overworked. It requires about four and a half days to rewind the whole armature and about one and a half days to repack the rheostat. The carbon brushes are renewed once a month, and the brake shoes once in two months. The car wheels have to be re-babbitted about once in every two or three months, and at present the cars are receiving a general overhauling after two years of service.

The cost of tramming ore, including the proportion of engine house expenses and maintenance, the wages paid to motor men and chute men have been as follows: 1894, $3\frac{9}{10}$ cents per ton; 1895, $4\frac{5}{10}$ cents per ton; 1896, to Aug. 1, $4\frac{5}{10}$ cents per ton.

This increase is partly due to raise in wages and partly to the greater average length of tram. The wages paid skip-tenders, the small amount of hand tramming, the cost of hauling timbers and filling rooms with sand and rock have not been included in the above. The train crew consists of a motor man and a switchman and from two to four chute men, who work either eight or ten-hour shifts, according to tonnage needed. The trains on each level usually consist of six cars, and when possible the original method is adhered to of dropping empties at the chutes while picking up the loads ahead.

The cost of installation has been as follows up to February, 1895:

Foundations	$ 1,050.66
Machinery	10,337 15
Drifting	25,469.79
Tracks	7,741.84
Wiring	4 988.20
Total	$49,587 04

The amount put down to drifting includes the necessary curves, and in certain places a more permanent route in the solid rock; also the long rock drift on the second level between the two deposits. Since February, 1895, the extensions of track and line have been charged to operating expenses.

Mr. E. F. Bradt, mining engineer at the Lake Angeline, followed Mr. Jopling with a similar paper on the electric haulage equipment of that mine. He showed a tramming cost under this system of 9.38 cents a ton. It was explained, however, that this included not only the cost of handling but of dumping the ore and the handling of all timber. The tramming account had also been charged with the expense of changing the electric haulage plant from the first to the second levels, this year, the laying of rails there, etc. The cost of 4½ cents a ton which Mr. Jopling had given for the Cleveland Lake shaft took in simply the items of engine house expense, motormen and brakesmen, and the labor cost of running underground pockets and chutes. [Mr. Bradt's paper will be given in full next week.—Ed.]

Mr. Olcott questioned the economy of a system giving a tonnage cost of 9.38 cents. At the Tilden mine, where they were tramming by hand from 350 to 1150 feet, with an average haul of 536 feet, the cost was 7½ cents a ton last year. In answer to a question Mr. Olcott said that the cost of handling timber was not included. Very little timber was used in the mine last year, and the cost had been but 1½ cents a ton.

Mr. Kelly observed that up to the present time by far the greater quantity of ore had been trammed by hand power. Wire rope haulage had been successfully employed at the Chapin. Later, electric haulage had been adopted in two Marquette range mines, as had been described. Still more recently animal power had been used in certain Vermilion and Mesabi mines, making in all four systems. He would say in general that wire rope haulage was adapted to situations in which the quantity of ore is large, the distance great and the levels straight. The electric system would be advantageous when the quantity of ore is large, the distance great and the levels tortuous, branches being necessary to reach outlying portions of ore. But where the quantity per level is smaller, the distance not quite so great and flexibility in operations necessary, animal power could well be employed Where the quantity of ore is smaller and the distance still less, hand tramming would probably be best. In response to the remark of Mr. Fitch that the use of animal power had its limitations in the impossibility of getting animals into many mines, Mr. Kelly said that he had seen mules employed in tramming at the Norman mine on the Mesabi range, and that they were also used on the Vermilion range.

Mr. Cole thought tonnage an important element in comparisons of tramming cost. He believed if the same items were taken in each case and the same system of cost-keeping followed, the costs under the two electric installations described would be found to agree very closely.

Mr. Olcott called attention to an important item which seemed to have been omitted from Mr. Jopling's account—the cost of getting the ore into the chute. On the Mesabi range, where ore was trammed 600 feet from the chutes, this cost is 2½ to 3 cents a ton.

Mr. Bradt explained, in answer to comments on the propriety of charging to tramming the expense of the new installation on the second level of the Lake Angeline East End, that it had been impossible, in the time at his disposal, to separate the various elements of the tramming account as kept on the books of the company. In the discussion that followed it was agreed that proper comparisons were almost impossible under the varying methods of bookkeeping and cost keeping. Further data will be presented, however, at a future meeting.

The Second Day.

A special train on Wednesday morning took the members of the Institute to Champion and Republic. At the former place the properties of the Champion Iron Co. were inspected. The power plant is one of the most extensive on the range and the whole property has a well-kept appearance. The theory of the management has evidently been that, even in the most unfavorable times, the best economy lies in making any expenditure necessary to prevent deterioration. In its 28 years the Champion has produced about 3,000,000 tons of hard Bessemer ore. The ore body is lenticular, with a pitch toward the west, and the eastern portions are now quite worked out, save the taking of the pillars. The hopes of the company are now largely centered in the No. 7 or westernmost shaft, and operations there have a favorable outlook. In 1893 and 1894 the mine was closed down; last year it was reopened and unwatered, and is now being as actively wrought as conditions will justify. The crushing plant installed last fall was inspected with interest. The crushers are set side by side over the railroad track and are run by manilla rope transmission from corresponding pulleys 10 feet in diameter on the crushers and engine shaft, and driven by a pair of Corliss engines. The pitmans are of steel instead of iron, as heretofore; the opening is 24 x 24 inches, and the ore is crushed into pieces of 1½-inch section by 2½ inches. The ore from the shafts runs by gravity to the crushers and falls directly into railroad cars, which in turn are run by gravity. The temporary and original crushing plant is used to crush stockpile ores, and an economical system of conveying has been devised. The safety appliances in connection with the operation of the man cages were a feature that attracted attention at this plant.

At the Republic, the old working was seen, from which millions of dollars worth of ore was taken in the old days of high prices, when the only scramble was by furnacemen anxious to get their due share of the product. A new three-compartment shaft is being sunk, which is now down 225 feet, and it is expected to work from it toward ore found with a diamond drill in 1895. The prospects of the Republic have improved considerably in the past two years, and it is hoped the new work now being done will be well rewarded. Hydraulic works are located on the Michigamme River, and the power generated there is sufficient, when the water is high, to meet all the air requirements of the mine; but at other times a steam plant helps out in driving the compressors.

From Republic the party was taken to Negaunee, where lunch was served. Early in the afternoon the Negaunee mine was visited. There is a single shaft sunk in the hanging, and its three levels have been worked out thus far. From the third level a shaft has been sunk on the foot wall, and from this there are six levels. A new hoisting plant has just been installed by the Webster, Camp & Lane Machine Co., Akron, O. The ore here is all Bessemer.

The Buffalo mine, one of the most active of the Buffalo group, which includes also the Queen, Prince of Wales and South Buffalo, was next visited. The ore is a soft non-Bessemer, the only exception being the Regent ore found in 1894 at the Queen. This, however, turned again to non-Bessemer as the depth increased. The original product of the Buffalo

was from an open cut working, but all operations are now under ground. The hoisting plant at this property received more than passing inspection from the visitors, not because of its size or finish or modern build, but because of the exceptional amount of work done with a single engine. Details of its performance are given elsewhere in the paper of Mr. Cole, read at the evening meeting.

The day's tour wound up with a trip over the new Lake Superior & Ishpeming road,, now completed from Ishpeming via Negaunee to Marquette, or rather to the new docks alongside Presque Isle, just outside the city. Both the Cleveland-Cliffs Iron Co. and the Pittsburg & Lake Angeline Co. are interested in this line, and it will carry their ore in the future. The road bed is surprisingly smooth, and the visitors found much in the scenery by the way to comment on, Dead River, with its high bridge, being particularly attractive in its picturesque beauty. The docks at Presque Isle are perfect in their construction and in their appliances for the speedy handling of ore. The party had an opportunity to watch the loading of a boat, and from what was seen it can be believed that very rapid work will be done. The 200 pockets have a capacity of 200 tons of ore apiece, making the total capacity 40,000 tons. The length of the docks is 1200 feet, or 1700 feet with approaches. The grade of the road is easy—1.6 per cent—and there is no reason why the best dispatch should not be afforded when everything is working smoothly. It is expected that 300,000 to 400,000 tons will go over this dock the present season. The ore cars are of 30 tons capacity.

Going into Marquette by electric car, the members took dinner at the Hotel Superior, and in its parlors the evening meeting was held. New members were elected, fully 25 being added on the recommendation of the council. The election of officers resulted in the choice of the following: President—W. G. Mather, Cleveland. Vice-presidents—Geo. H. Abeel, Hurley, Wis; J. F. Armstrong, Hibbing, Minn. Managers—Graham Pope, Houghton, Mich.; Wm. Kelly, Vulcan, Mich.; C. H. Munger, Ironwood, Mich. Secretary—F. W. Denton, Minneapolis. Treasurer—Geo. D. Swift, Duluth. The new president was escorted to the chair and spoke happily of the work of the Institute and of the success of the present meeting.

A Single-Engine Hoisting Plant.

Mr. T. F. Cole, manager of the Buffalo group and other mines, was then introduced and read the following description of a hoisting plant which the party had inspected in the afternoon:

During November, 1889, the writer was called to superintend the work of mining ore at the Queen, Prince of Wales, Buffalo and South Buffalo mines. At the Prince of Wales the former operators had purchased and installed a hoisting plant consisting of one 18 x 24-inch slide valve engine geared to drive two six-foot diameter by five-foot face hoisting drums. On the crank shaft was placed a fly wheel eight feet in diameter to steady the engine. The machinery was built by the Iron Bay Mfg. Co., of Marquette, and designed to hoist single skips or cages in one or more compartments of a shaft or shafts. The shaft at that time being sunk was vertical and soon reached a depth of 265 feet from the surface and the first level was opened. The ore on this level was small in quantity and shaft was sunk to a depth of 310 feet and the second level opened. The ore on this level was of small proportions, consequently up to this time only one compartment of the shaft was used for hoisting ore through. The ore in this mine was pitching at an angle of 38 degrees to the west and away from the shaft. To determine if we would find an increase in the size of the ore lens below the 310-foot level, we sunk a small shaft in the ore from this level to a point 65 feet below, and on opening the ore body with drifts and crosscuts from the bottom of the small shaft we found the ore area had largely increased and the whole outlook was so favorable that we decided to sink the main shaft 140 feet more and drive 465 feet through rock on this new level to reach the ore. This work was done, the drift being of sufficient width to permit of our installing a rope haulage plant, using double tracks to tram our ore an average distance of 680 feet from stopes to shaft.

The ore area on this 450 foot level was of sufficient size to cause us to cast about and find some means of hoisting a large quantity and at minimum cost.

The weight of skip was	2,200 lbs.
450 ft. 1¼" Wire Rope	1,000 lbs. (approximately)
Load of Ore	4,600 lbs.
Total	7 800 lbs.

Each drum was operated by power transmitted to it from the drum shaft by means of an outside band friction, and we found that the strains on the engine and frictions were becoming too severe for the good of the machinery or for safety. The only way to secure economy was to run our skips in balance and it was decided that by adding another eccentric with link and tumbling block that we could make that single engine accomplish what we desired. The work on the engine was quickly done by the Lake Shore Iron Works, of Marquette, and gives good satisfaction.

To reduce strains on driving frictions, we decided we could pass a rope over the sheave on the top of the shaft house with each end fastened to the bail of skip in either compartment of the shaft and taut enough to take the weight of the skips off the friction. Then the question of getting our men into and out of the mine led us to put cages in both compartments of the shaft and the total weight of the cage, car, ore and rope was then reduced from former load so that the frictions would hold with safety.

This machinery is now hoisting daily 800 tons of ore from 450 feet in depth, operating the cages in balance. We stop the engine each trip of the cage and find no difficulty from engine centering. Any one having a similar plant can utilize it to hoist in balance and if drum capacity is sufficient, 1,000 tons per day can be raised from a depth of 700 feet or under, provided the cars are delivered at the bottom of the shaft with fair regularity. This is the first attempt the writer knows of where a single engine has been utilized to hoist cages working in balance.

The economy of the plant is fairly illustrated by the fact that one 5-foot diameter by 16 foot long tubular boiler is easily furnishing sufficient steam to operate the engine, heating a one-story building 12 x 36 feet, and a one-story dry building or change house 24 x 160 feet in size, driving a No. 7 Cameron pump located at the bottom of the shaft above mentioned, that elevates 45 gallons of water per minute 140 feet to the main pumping plant, and furnishing power to operate the rope haulage plant that is tramming daily 800 tons of ore an average distance of 680 feet.

Pumping Engine at the Pioneer Mine.

The following communication by H. B. Sturtevant, superintendent of the Pioneer mine, was read by the secretary:

I beg to submit the results of an efficiency test on our mine pumping engines. They are of the duplex compound plunger type, made by the Fred M. Prescott Steam Pump Co., of Milwaukee. The condensers are the single acting independent type. One of these pumping engines throws water 780 feet vertically from the bottom of the shaft. This is the one tested. The other is stationed 150 feet higher, and is used as a relay pump, a smaller duplex pump throwing up to it.

We attempted to obtain an evaporative test on our Stirling water tube boilers in connection with the above test, but we were disappointed in some of the details, and the test is not satisfactory for scientific purposes. The figures, however, showed better than twelve pounds of water evaporated for each pound of combustible from and at 212 degrees.

We attempted to determine the actual slip of the pumping engine, but owing to the irregular shape of the sump our test was not satisfactory. We therefore assumed it to be five per cent, which is reasonable, as the engine has been running but six months and is in fairly good condition. We have on each of the caps of the discharge valves a small air chamber, made of four-inch pipe and 12 inches long; connected with the valve chamber by one-inch pipe and valve. The effect of these air chambers is to make the valves seat themselves easier, as is manifested by the absence of sound; and also to start the valves with less steam pressure; or, in effect, to increase the valve area, on the theory that the air in the water rises to the top of the chambers and affords a cushion. To our master mechanic, Mr. R. J. Williams, belongs the credit of this contrivance, which has not been used elsewhere to our knowledge, and which we recommend for the consideration of mining men.

The main steam pipe is six inches diameter and 1100 feet

long, and is covered with Manville covering. We use two expansion joints in the shaft. Size of column, eight inches inside. The boiler pressure was 110 pounds, but at the pump it was throttled down to 75 pounds. The pumping engine was running at 80 per cent of its rated capacity. Dimensions: Cylinders—high 16 inches; low, 30 inches. Plungers, 9 inches. Stroke, 24 inches. Revolutions per minute, 18½. Displacement, 481 gallons per minute. Slip, 5 per cent. Steam pressure, 75 pounds at branches. Vacuum, 27 inches. Coal consumed per minute, 11.8 Ash, 10 per cent. Duration of test, eight hours 35 minutes. Date of test, July 9, 1896. Foot pounds per 100 pounds of coal, 25,100,000. Foot pounds per 100 pounds of combustible, 28,000,000.

Hon. Peter White was introduced to the Institute after the business of the evening had been concluded, and entertained the members with some reminiscences of the early days of Marquette, his perfect reproduction of the French dialect and his sense of humor making his recitals inimitably amusing.

The Third Day.

A special train out of Marquette, on Thursday morning, over the D. S. S. & A., connected with the Northwestern train at Ishpeming and brought the visitors to Escanaba, whence the steamer Lotus conveyed them to Gladstone. Here was seen the new charcoal furnace plant of the Cleveland-Cliffs Iron Co. and its chemical plant for the manufacture of wood alcohol and acetate of lime. The equipment has already been fully described in these columns. Under the management of Mr. Austin Farrell, the furnace has been brought up to gratifying efficiency, after passing through the besetments belonging to all new plants. There was general surprise among the visitors at the extent of the operations at Gladstone and the completeness of the equipment. The return trip was also by boat and rail. From Escanaba to Negaunee—61 miles—the Chicago & Northwestern train made the run in 62 minutes, including three stops at stations and one stop for water. Several of the miles were made at the rate of a mile in 57 seconds.

The next meeting of the Institute will probably be held on the Gogebic range, at Ironwood, Mich.

A pamphlet descriptive of the mines on the Marquette range, prepared by Geo. A. Newett, editor of *Iron Ore*, Ishpeming, and State Commissioner of Mineral Statistics, proved of much assistance to the members.

The work of the local committee in arranging the itinerary of the meeting was generally commended. All details were well worked out and the social features were much enjoyed.

The Case of Silver in Summary.

Dun's Review, after giving at length the history of silver coinage legislation, with facts concerning the price, the coinage ratio of silver and gold, etc., puts the whole matter in a series of conclusions. These are stated as follows:

1. That it has never been possible, even with free coinage, in most countries as before 1873, to maintain silver and gold at any definite and steady ratio of price.

2. That a slight variation in the market ratio from the coining ratio, meaning a slightly higher price paid for silver or for gold in other countries than it is worth in the form of coin, has invariably swept all the silver or all the gold out of use, and thus brought mono-metallism where the law was designed to establish and maintain bi-metallism.

3. That bi-metallism, the actual concurrent use of both metals at a recognized valuation, has never been established or maintained in this country, having been defeated from 1792 to 1834 by undervaluation of gold, and from 1834 to 1862 by undervaluation of silver, and from 1862 to 1879 by universal use of legal tender paper instead of any coin, and from 1879 to this date by depreciation of silver coins which have passed only as representative of gold.

4. That the Act of 1873 had no effect upon the use or the price of silver, because business was transacted and prices were fixed in a legal tender currency then much cheaper than gold, as gold was relatively cheaper than silver.

5. That the coining since 1877 of over fifty times the amount of silver coined in 86 years prior to that date has not helped the price of silver.

6. That every attempt in this country to bring about free coinage or larger use of silver has actually caused so great an increase in the production of silver as to depress the price.

ELECTRIC TRANSMISSION OF RIVER POWER.

The power of the Kern River, third in size of California streams, is now about to be utilized, the work undertaken by the Power Development Co. being nearly completed. The contract for the electrical equipment has been awarded to the General Electric Co., whose three-phase apparatus will be used to transmit the power of the river to Bakersfield, a distance of 14 miles as the bird flies.

The point selected for the power house is at the mouth of the canyon on the north side of the Kern River, almost 16 miles northeast of Bakersfield by wagon road. Here the stream, after a boisterous course of 100 miles from the slopes of Mt. Whitney through a series of rugged, precipitous canyons, forms a number of cataracts and rapids previous to taking a placid course through the cultivated valley lands. The point of diversion of the necessary flow for the power is 9,000 feet up the canyon. Some idea of the difficulties to be overcome in this work may be gained from the facts that to secure a bed for the flume a roadway was cut from the solid rock along the sides of the canyon. All the timber was hauled by a team a distance of 16 miles to the south side of the river. A bridge was thrown across and a tramway 325 feet long, with a grade of 30 per cent laid up the steep hill to the point where the flume was to end. A steam sawmill was then set up at the foot of this tramway, the timber cut to proper dimensions, loaded on the cars and hauled up the grade. The flume was begun at the power house end. This flume is eight feet wide and six feet deep and is covered. A railroad track is laid upon the cover for the full length of the flume, 8,000 feet. There are no sharp angles, the changes in the course being made by curves and tangents. The grade is 5.8 to the mile and 475,000 feet of red wood is used in the construction of the flume, which at one point is carried on an arch with 60 feet span over a bad place on the cliff. The flow is calculated at 280 cubic feet per second. At is terminus at the mouth of the canyon 8574.9 feet from the point where it leaves the river, it is 202 feet above the power house. Here the water enters a steel pipe 540 feet long and 5 feet 6 inches in diameter. The fall from the end of the flume to the power house is 201.9 feet and the capacity of the water is estimated at 7,500 h. p.

The electrical equipment will consist at first of two 450 kilowatt General Electric three-phase generators running at 257 revolutions per minute. The voltage at the dynamo terminals will be 550 volts. This will be raised in step-up transformers to 11,000 volts and will be carried on six No. 4 bare copper wires to the sub-station at Bakersfield, where it will be transformed down to 2,000 volts for distribution.

The current will be utilized at first to operate an extensive system of electrical railroads connecting Bakersfield with Kern and other districts. It will also be applied at once to street and house lighting, as well as to the operation of pumps for irrigation purposes. The mines in the mountains to the east will also probably take current for their mills, hoists, pumps, etc. The work is being pushed to completion as rapidly as possible and it is expected that by Nov. 1 the current will be turned into the transmission wires.

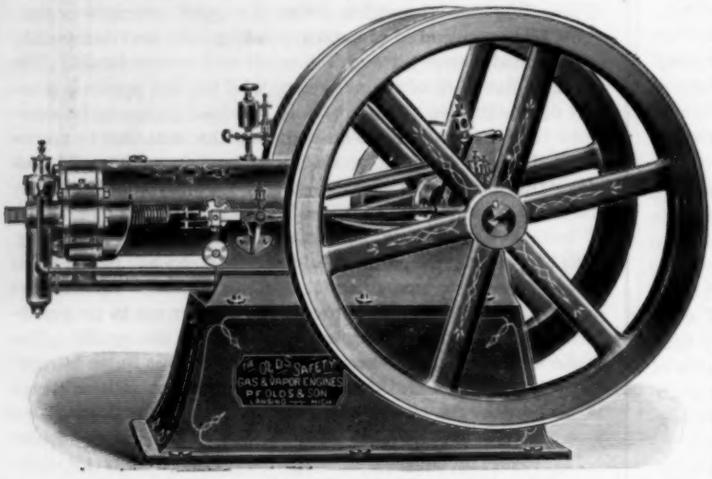
Union Steel Co. Receivership.

The Union Steel Co., of St. Louis, whose plant is at Alexandria, Ind., went into the hands of a receiver Aug. 24. The plant was built in 1893–95, and was added to by the removal of part of the machinery formerly operated by the New Albany Rail Mill, at New Albany, Ind., and the Valley Steel Co., at Belleville, Ill. Operations were begun early the present year, but the financial agitation has so cut off trade that the plant had to be shut down. Large obligations were outstanding which there was no means of meeting, and the improbability of an early improvement in business led to the step taken. The company is capitalized at $1,500,000 and puts at $1,000,000 its investment in stock, machinery and plant at Alexandria. The Bessemer steel department consisted of two five-ton converters removed from Belleville. The plant covered nearly 30 acres and could employ 1600 men when running full.

The National Tube Works, at McKeesport, Pa., are operating their lap department and two furnaces of the six in the butt weld department.

OLDS GAS AND GASOLINE ENGINE.

The Olds gas or gasoline engine contains several new features which entitle it to consideration. The material is so distributed as to present the greatest resistance in the line of motion between the cylinder and crank shaft, and furnish within itself both of the bearings for the main shaft, so situated as to receive all work of the engine in the fixed part of the bearings without any strain on the caps, with the advantage of no quarter boxes to be adjusted and throw the shaft out of alignment, the shaft being absolutely and permanently square with all the working parts of the engine; with a steel crank shaft of sufficient size to prevent quivering of the



balance wheels at each impulse or working stroke. Every part of the engine is of such proportions made to assure great strength and durability.

The engine has the advantage of dispensing with gears, cams, lateral shafts, etc., yet retains the alternating movement. A plain eccentric is used on the main shaft. The exhaust and compression is operated by the revolving, alternating wheel on the slide at side of bed plate which is operated by the eccentric, the reciprocating motion operating the wheel, which opens and closes the exhaust valve in straight line. The operator can handle the engine easily by simply throwing out the paul which operates the alternating wheel; by so doing the compression is dispensed with and the engine can be run to any point without the annoyance of the compression interfering. The back-gearing gear is dispensed with, giving a quicker movement in opening and closing the valves; where gears are used, long strokes are required in order to open and close the valves in time, or cams are used which are exposed to dust and grit and must necessarily be short lived. The governor used is very sensitive and regulates closely. It operates on the exhaust valve, holding it open when speed is above normal, thereby allowing the cylinder to fill and empty from the exhaust as the piston moves to and fro. During idle strokes no vapor is continuously worked through the cylinder and no continuous compressions or vacuums take place with each stroke, compressions or vacuums being a loss of power. The governor is also at rest with the exception of when the engine is above required speed and then the movement is very slight; at will the speed can be varied at least fifty revolutions. The automatic inlet valve is directly opposite the exhaust valve, there being but two valves to the engine, both of poppet type and same size. Each valve and seat is held in position by three studs which are easily removed, allowing easy access to the valves. The operation of both valves is in plain sight; no valves fall to their seats by gravity. The engine is neatly painted and all working parts highly polished; the combustion chamber is water jacketed and finished throughout, with brass jacket extending between the two finished flanges and around the valve chamber. The engine is equipped with sight feed oilers. It is built by P. F. Olds & Son, Lansing, Mich. Further information and description will be sent on application.

NEW BALL CASE GRINDER.

Among the many improvements which are being shown bicycle manufacturers is the '97 pattern ball case grinder illustrated herewith. This machine was put on the market some years since at the time when the attention of manufacturers was being turned toward the subject of grinding their bearings. Since that time some changes have been made in the details of the machine, but no such radical departures as are shown in this pattern.

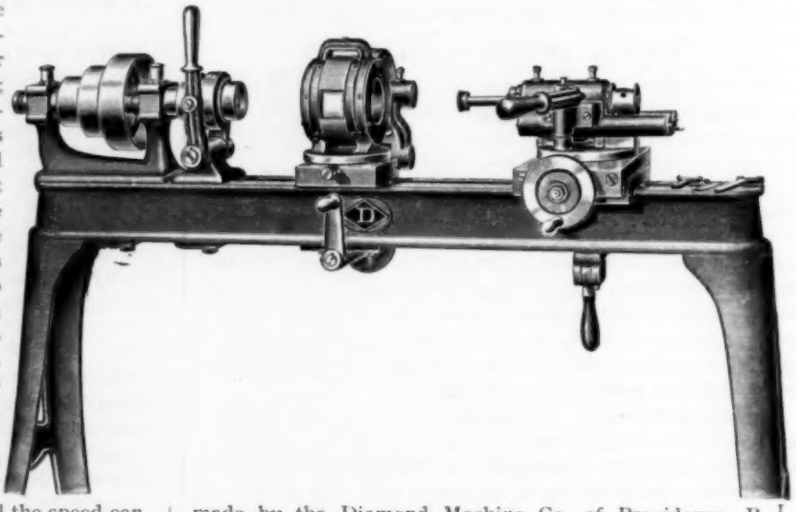
In the old machine the cups and cones were held in a three-jawed chuck which was slow to operate. The draw back chuck on the new machine is arranged to hold split collets of various sizes within its capacity, and these are fitted at the factory to cups and cones furnished by the bicycle maker. One movement of a lever serves to tighten or loosen the chuck, as desired.

The revolving head shown in the center of the bed has a taper hole into which fits a specially designed chuck so arranged that hubs may be held by the barrel or by the flange. If but one emery wheel is used the head is swiveled half way round, when one bearing is ground, in order to grind the bearing at the other end of the hub. Sometimes two emery wheels are used, one on each end of the hub, in which case it is not necessary to revolve the head. This revolving head was formerly driven by a belt, but it is now propelled by a friction wheel shown at the back. This is made to engage with the head by a lever shown in front, which actuates a cam wheel on the back of the machine.

The emery wheel slide rest was formerly made so that the spindle moved back and forth by means of a lever. This exposed some bearing surfaces to the action of emery dust. The present device of causing the whole rest to move on protected slides, by means of a rack and pinion movement, gives very much better results.

The revolving head and the emery wheel spindle are both equipped with ball bearings accurately ground. This permits a very high speed to the emery wheel without heating, and gives a better chance to protect the bearings from the entrance of emery dust.

The manufacturers have sold only a few less than 200 of these tools to bicycle manufacturers in the United States, France, England and Germany. This machine, together with complete line of grinding and polishing machinery, is

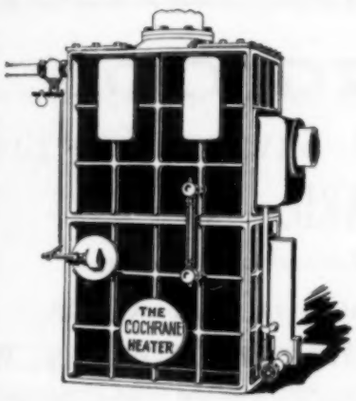


made by the Diamond Machine Co., of Providence, R. I.

THE Allegheny, Pa., councils decided last week, by unanimous vote, to install in the Howard Street pumping station Davis return flue water tube boilers and to equip them with the Playford stoker, manufactured by the Playford Stoker Co., of Cleveland.

THE Boston Mfg. Co. has been incorporated at Chicago, to manufacture machinery. The capital stock is $2,500, and incorporators, E. S. Atwood, W. H. Lyman and Geo. W. Warvelle.

THE strike at the American Tin Plate Works, Elwood, Ind., has ended with the signing of the scale.



Don't stop buying coal—but don't buy so much.
Put some of your capital in a good feed-water heater.

THE COCHRANE HEATER

IS A DIVIDEND EARNER,

paying on its cost 100 to 500 per cent
per year, according to the conditions.

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Manufacturers of
THE COCHRANE HEATERS.
THE COCHRANE SEPARATORS.
THE WHARTON-HARRISON SAFETY BOILERS.

WHEN TO USE A CONDENSER.

Wm. H. Weightman, writing in the September *Cassier's*, discusses the economies of the condenser. In general, he says, it is advisable to use a condenser when there are ample cooling materials, fluids or mediums of any kind in sufficient quantities to be applied to a ready and economical withdrawal of the final heat from the steam after final use, to change it back to water at greater or less temperature. Under such circumstances there, of course, arises the question of obtaining handling and operating the cooling medium without too great a cost. Although water at ordinary temperatures is the prevailing cooling material, any fluid capable of being brought into direct or indirect contact with the steam or vapor as discharged may be employed.

If, in engine practice, this heat could be withdrawn during and by actual work within the cylinder, no hindrance being experienced through the presence of the resulting water, the most economical condition and use of steam in engines would be reached. Such not being the case, the condenser is connected for the purpose.

Although an expensive assistant, the fact that it develops a liberal or even a medium profit on the investment is a sufficient cause and postive recommendation for its use. There may, however, be additional uses to which it may be applied with ready economy, the heating of buildings, for example, of drying rooms, of water for special uses and similar objects. These may take up a portion of the surplus heat and thus reduce the pressure of the steam, but, except by the use of the condenser or some equivalent, no vacuum can be established.

The nature and latitude of the locality of the plant has considerable influence in the condenser problem. Equatorial waters at comparatively high temperatures are not as efficient as those of more northerly or southerly locations. The chemical nature, too, and the cleanly condition of the water to be used, both become a governing element in the mechanical branch of the problem. The use of the surface condenser, in preference to the jet condenser, is at all times advisable, and, in fact, necessary where the waters to be used for cooling purposes contain elements and ingredients detrimental to economical operation.

We are in a position to make the announcement of very large transactions in Alabama iron by outside parties, who are attracted by the low prices and buy for investment. The line of argument is that pig iron at cost prices, in the cheapest center of production in the world, is the nearest equivalent to gold in essential value that can be found, and as a form of property to stay with through the silver agitation, nothing is better. The sales of this character, that we know of, amount to about 60,000 tons. The delivery is mostly by American Pig Iron Storage Company's warrants in the yards at Birmingham. The sales would be sufficient to influence the market sharply if there was anything like normal demand. It seems quite probable that there will be more of this kind of investment, and that when regular consumers enter the market for supplies they will find the supposed large accumulation of stocks not available.—[Rogers, Brown & Co.'s New York letter.

INDUSTRIAL SUMMARY.

New Buyers in the Market, and Some of Their Wants :—

[If you are in need of machinery of any description, please notify *The Iron Trade Review* and we will put you in communication with our advertisers at once.]

The Taylor Iron & Steel Co., Montreal, Can., has been incorporated with a capital stock of $30,000.

The company that purchased the Moore Mfg. & Foundry Co.'s plant at South Milwaukee has organized under the name of the Stowell Mfg. & Foundry Co., successors to the Moore Mfg. & Foundry Co. The officers elected were: J. M. Stowell, president; Geo. P. Jones, vice-president; M. H. Brand, secretary; Chas. E. Sammond, treasurer. Active operations will begin at once.

The Fountain Machine Co., of Cincinnati, has been incorporated with a capital of $25,000, by Emil Hilstach, Anthony Goeshel, John S. Thompson, John E. Jones and Louis E. Fricke. The company will manufacture hot air engines, gas engines and gasoline engines, and do a general business in manufacturing, dealing in, and repairing engines.

It is announced that a factory for the manufacture of gas engines will be constructed at Beaver Falls, Pa. E. W. and L. L. Bentley are the parties interested.

New Construction :—

Lewis & Wallace, patentees of the Crown automatic car coupler, will probably locate a plant at Albany, N. Y.

The Hyde Windlass Co., Bath, Me., is building a foundry 190 x 100 feet; machine shop 150 x 80 feet; pattern shop 60 x 40 feet, and pattern store-house 10 x 80 feet. For power there will be required one 40 h. p. slow-speed electric motor, three 15 h. p. standard medium speed motors, and one 10 h. p. standard medium speed motor. The foundry will have a 20-ton traveling crane, and the machine shop a 15-ton traveling crane, both electric and both ordered. The company is in the market for heating plant and blowers for the foundry.

It is announced that the terminals and new shops of the B. & O. railway at Cumberland, Md., will be ready for occupancy Sept. 1.

The Penn Bridge Co., of Beaver Falls, Pa., has been awarded the contract for the iron roof trusses and roof for the gun carriage shop of the Government Ordnance Shop at Washington. Its bid of $18,400 was the lowest.

The Victor Mfg. Co. will erect a new building at Canonsburg, Pa.

Additions, Enlargements, Removals, Etc. :—

The Baltimore & Ohio Railroad is making a large addition to its casting-yard at the shops in Glenwood, Pa., where all the heavy work is done.

For its new machine shop, the Lloyd-Booth Co., Youngstown, O., has placed contracts with Manning, Maxwell & Moore for one "Shaw" patent 30 ton capacity and 60-foot span electric traveling crane of the three-motor type, one 54-inch swing by 40-foot bed engine lathe, and one 30 x 30 x 8 inch planer. A

MOUNT SAVAGE FIRE BRICK.

UNION MINING CO.,

Proprietors of the CELEBRATED Mount Savage Fire Brick

GOVERNMENT ⁂ STANDARD.

Established 1841. Capacity, 60,000 Per Day; 18,000,000 Per Year.

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TENSILE STRENGTH, 60,000 TO 80,000 LBS.

Homogeneous, Clean and Solid. Suitable for Car Couplers and Knuckles; Crank Shaft and Gearing.

MADE FROM 10 TO 10,000 Lbs. IN WEIGHT. ESPECIALLY ADAPTED FOR

Electrical Work because of its Superior Conductivity.

MADE ONLY BY

EAST CHICAGO FOUNDRY CO., 716 THE ROOKERY, CHICAGO.

ABSOLUTELY SMOKELESS FURNACES.

THE AMERICAN SMOKELESS FURNACE CO.

The "CLEVELAND" is the Best UNDERFEED Furnace.
The "CUYAHOGA" is the Best DOWN DRAFT Furnace.
Both ARE SMOKELESS.

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Stowe, Fuller & Co.

WESTERN AGENTS OF
Mount Savage and Queen's Run Fire Brick,
The leading BRICK of this country.
MANUFACTURERS OF
OHIO FIRE BRICK. ALL SHAPES IN STOCK.
The largest shippers of FIRE BRICK in the West.
Warehouse and Docks: 185-193 Merwin Street,
CLEVELAND, OHIO.

new engine, boiler, generator and electric light plant will be installed, so that the new shop can be operated independent of the present machine shop, which latter will be used almost exclusively for roll turning and erecting.

The Morris Machine Works, Baldwinsville, N. Y., have recently built an extensive addition to their foundry, and is crowded with orders for both pumps and engines.

The removal of the Westinghouse Electrical & Mfg. Co. from Allegheny to East Pittsburg, which has been going on gradually for some time, is about completed and the new plant is about ready for work. Business is quite slack, however, and only about half of the usual number of men are employed.

The Wheeling Corrugating Works, Wheeling, W. Va., are building an addition to their plant.

General Industrial Notes:—

The Welivar Mfg. Co., of Philadelphia, Pa., is engaging in the manufacture of bicycles and has just purchased from the Davis & Egan Machine Tool Co., Cincinnati, O., its entire equipment of hub machines, engine lathes, drill presses, milling machines, shapers, etc.

The Davis & Egan Machine Tool Co., of Cincinnati, O, has just brought out a new hub machine that will form, drill and cut off 100 rear hubs in ten hours. The company has orders on its books from England, France, Denmark, Sweden, Canada and quite a number in the United States. It reports an exceptionally good foreign business in bicycle machinery.

Attention is called to the advertisement of the W. A. Jones Foundry & Machine Co., Chicago, which appears on the front cover of the present issue. This firm is coming rapidly to the front as one of the recognized authorities on the various forms of power transmission in all of its various forms, and particularly invites difficult problems in its line. Having its own foundry and machine shop under one roof and management, both of them thoroughly equipped with modern tools and appliances suited especially for its requirements, the company is prepared to execute orders promptly. Catalogue will be sent on application.

At a recent meeting of stockholders of the Armington & Sims Engine Co., Providence, R. I., it was voted to ask for

U. BAIRD MACHINERY CO.

PITTSBURG, PA.

Have a Special Lot of Second-Hand Tools. All in First-Class Condition.

1—55″ Allen Riveter.
1—24x24x7 ft. New Haven Planer.
1—30x30x8 ft. Harrington Planer.
1—36x36x18 ft. Sellers Planer.
1—36x36x20 ft. N. Y. Steam Engine Co. Planer.
1—16x18″ Lathe & Morse Crank Planer.
2—15″ Hendey Shapers.
1—15″ Youngson Shaper.
1—15″ Smith and Mills Shaper.
1—10″x5′ Prentice Engine Lathe.
1 each 14″ and 15″x6′ Ames Engine Lathe.
1—16x5 ft. Bullard Engine Lathe.
1—18x8 ft. L. W. Pond Engine Lathe.
1—24x8 ft. Phillips Engine Lathe.
1—24x14 ft. Lathe & Morse Engine Lathe.
1—38x14 ft. New Haven Engine Lathe.

AND MANY OTHERS.

We have all the best makes of New Tools. Send for Second-Hand List.

Your machinery and tools

NEED PROTECTION

against rust and corrosion.

Bright metal surfaces will rust over night, and will spoil if shipped any distance, unless coated with a reliable slushing compound. Many different articles are used to prevent rust, but most of them do not adhere to the metal, and rub off wherever handled; or they will stain the metal; or they contain or take up acids, and will not keep off rust for any length of time; or if they do adhere, it takes a great deal of time and labor to remove them.

These disadvantages are overcome by using

MANNOCITIN.

Let me send you a sample free of charge, and compare it with what you are now using. It has many advantages, and is used and recommended by firms known all over the country.

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E. A. KINSEY & CO., CINCINNATI, O.

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AIKEN Duplex and CRITCHLOW Valves, either three or four way, for operating Mill and Hydraulic Machinery of all kinds under any desired pressure, and Stop Valves for same.

Agents for the CAMERON STEAM PUMP, which is made in every possible variety, and suitable for all purposes to which Steam Pumps can be applied.

Nos. 108 to 118 Third Avenue, PITTSBURGH, PA.

an extension of three years. The company owes $275,000 and has assets of $270,000. It is said to have a number of orders on hand.

The Bethlehem Iron Co. has shipped 16 tons of material for 13 and 4 inch guns to the Washington Navy Yard.

Watts Furnace, at Middlesboro, Ky., lately closed down, will soon open up again. The large steel plant will also be put in operation. The immense machine shop, the largest in the State, is already in operation, and will soon have at work a force of 500 men.

The Hattie Ensley Furnace, at Sheffield, Ala., was blown in on August 5 by the Colbert Iron Co., lessee.

Wm. Baragwanath & Son, 48 to 52 West Division street, Chicago, have finished one of the largest steam jacket feed water heaters ever constructed, having a capacity of over 2000 h. p. They are building two others of equal capacity. All are for the new electric power plant which the Chicago City Railway Co. is erecting.

The Shelby Steel Tube Co., Shelby, O., is installing new Corliss engines which will give it greater power and increase its capacity to at least 2,000,000 feet per month.

E. W. Bentley, of New Brighton, and L. L. Bentley, of Pittsburgh, have perfected a gas engine of improved designs, which will be manufactured in Beaver Falls.

The Totten & Hogg Iron & Steel Foundry Co., of Pittsburg, Pa., manufacturers of rolling mill machinery and engines, has received an order from the Laughlin Nail Co., of Wheeling, West Va., for some more mills, shears, etc. The company is now also finishing and shipping the machinery for the Connellsville Steel, Iron & Tin Plate Co., Connellsville, Pa. The company reports that orders for rolls are very good.

The Union Foundry & Machine Co., of Pittsburgh, Pa., has just finished a shipment of machinery to the Washington (Pa.) Steel & Tin Plate Works, including a slitting shear, and has filled an order for tin house machinery from the Ellwood Tin Plate Co., Ellwood City, Pa. It is also furnishing two cranes for the new plant of the Blackham Mfg. Co., at Zelienople, Pa.

The charcoal stack of the Hecla & Iron Mining Co., at Ironton, O., will be blown in about Sept. 1.

Furnace No. 1 of the Ashland (Ky.) Coal, Iron & Railway Co., which has been shut down for some time undergoing repairs, consisting of a new lining, etc., is being dried out and will be put in blast again soon.

At the annual meeting of the Lackawanna Iron & Steel Co., of Scranton, Pa., the following directors were elected: Edwin F. Hatfield, president; Samuel Sloan, Wm. E. Dodge, Harry A. C. Taylor, Moses Taylor Pyne, Stephen S. Palmer, Walter Scranton, DeWitt C. Blair and James Blair.

The Pennsylvania Steel Co. will soon blow out its No. 2 blast furnace at Steelton, Pa. It is the largest at the works and has been in successful operation for almost 20 months. It is capable of producing two hundred tons of iron per day, and during this period in blast has exceeded that figure. The stack will be relined.

The Westinghouse Electric & Mfg. Co., Pittsburg, has now in course of construction the largest dynamo yet built by them, weighing 90 tons. The base is 17 feet 6 inches and has been

cast in two sections each weighing 56,00 pounds. Three more are to be built, the four going to the Allegheny County Light Co.

A meeting of the stockholders of the Pittsburg Bridge Co. has been called for Sept. 1, to vote on a proposed issue of $100,000 of preferred stock.

The jobbing department of the Sharon Iron Works, Sharon, Pa., is running on double turn.

A fire in the laboratory of the Edgar Thompson Steel Works, on Sunday, caused great inconvenience by reason of the destruction of valuable papers, ore tests, etc., which cannot be replaced. The damage to property was slight.

It is probable that the furnaces of the Riverside Iron Works, Wheeling, W. Va., will be idle after the 30th, since the men still firmly decline to accept the proposed reduction in wages.

The Bellaire (O.) Steel Works are idle.

At Uniontown, Pa., the Oliver Coke & Furnace Co. blew out 300 ovens, leaving only 200 of their 629 in blast. Lack of orders is the cause of the shutdown.

The Jefferson Furnace, at Jefferson, O., is being relined and completely overhauled during the present shut down.

The new plant of the Blackman Mfg. Co., at Zelienople, Pa., is about completed and will be occupied soon.

Jones & Laughlins, Limited, Pittsburg, are temporarily idle in all departments.

The Homestead Steel Works are again running in all departments.

All departments of the Spang Steel & Iron Co., at Sharpsburg, Pa., have closed down indefinitely, owing to the unsettled condition of business. About 700 men are thrown idle.

The American Stoker Co., Dayton, O., has recently furnished the following stoker equipments: Pennsylvana Co. shops, Columbus, O., second order; Davis & Egan Machine Tool Co., Cincinnati; Toledo Brewing & Malting Co., Toledo, O; Michigan Carbon Works, Detroit, second order; John C. Roth Packing Co., Cincinnati; Cleveland City Water Works, Cleveland.

The Bucyrus Co., of South Milwaukee, Wis., has recently shipped two heavy steam shovels of improved pattern, one to the Pittsburg, Shenago & Lake Erie Railroad, which is at work at Conneaut, O.; the other to Winston Bros., contractors for the Northwestern double track between Madison and Elroy, which is at work at Devil's Lake, Wis. These shovels are of the 50-ton size, and are giving entire satisfaction. The Winston machine is their second order for the same size shovel. On July 25 this shovel loaded 226 cars of gravel and clay, with some stones, in eight hours' actual working time. The cars were standard flat cars, holding about nine cubic yards each.

Take Your Vacation Now.

Go to picturesque Mackinac Island via the D. & C. (Coast Line). It only costs $13.50 from Detroit, $15.50 from Toledo, $18 from Cleveland, for the round trip, including meals and berths. Tickets good for 60 days, bicycles carried free. One thousand miles of lake and river riding on new modern steel steamers for the above rates. Send 2c. for illustrated pamphlets. Address, A. A. Schantz, G. P. A., Detroit.

At a special election held last week the citizens of Sharpsville, Pa., voted in favor of water works, to cost about $35,000.

To Picturesque Mackinac via the Coast Line.

It only costs $13.50 from Detriot, $15.50 from Toledo, $18 from Cleveland for the round trip, including meals and berths. One thousand miles of lake ride on new modern steel steamers for the above rates. Send 2c. for illustrated pmaphlet. Address A. A. Schantz, G. P. A., Detroit, Mich.

A portion of the puddle department and the guide mill of the Union Iron & Steel Co., Youngstown, O., resumed work last week.

D. & C. Summer Service to Mackinac.

Their new steel passenger steamers are all in commission making four trips per week between Toledo, Detroit, Mackinac, Soo, Petoskey, Duluth. If you are contemplating a summer outing, send 2c. stamp for illustrated pamphlet. Address A. A. Schantz, G. P. A., Detroit, Mich.

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HIGH SPEED OR GEARED **CRUSHING ROLLS**

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4,500	feet	new	8	inch	piping.
6,000	"	"	8	"	"
12,000	"	of	12	"	"
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One Worthington Pump, 1,500,000 gals. capacity.

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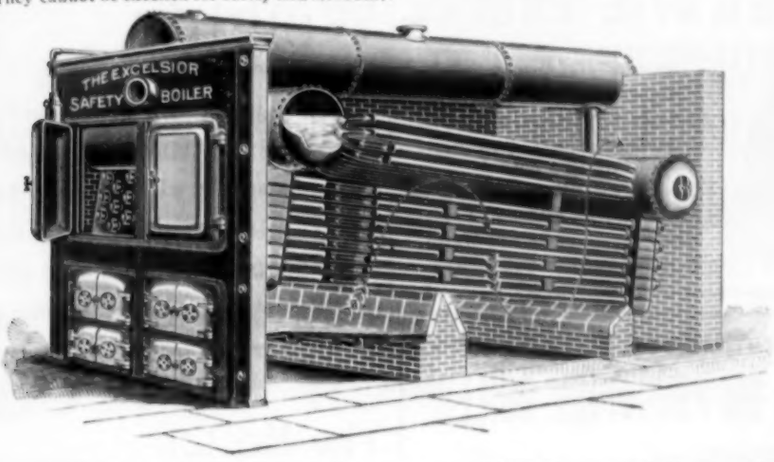
They cannot be excelled for Safety and Economy.



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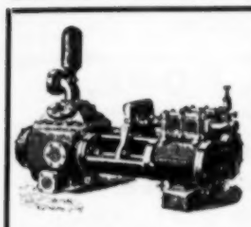

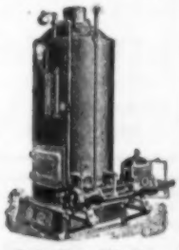

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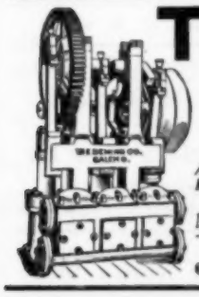

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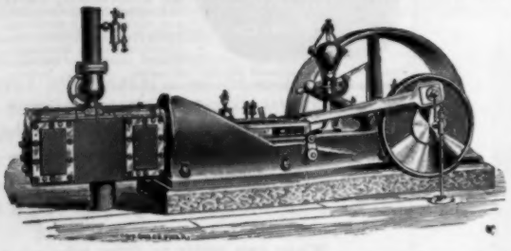

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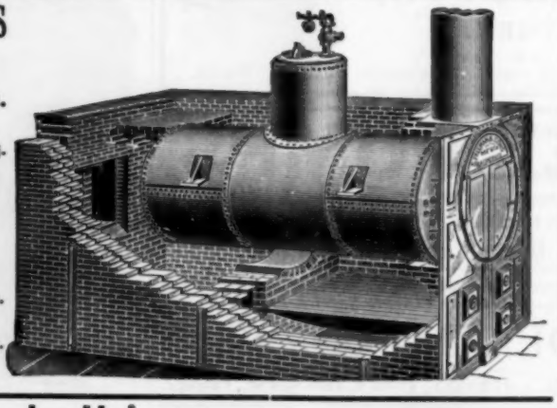

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It depends upon getting the HEAT to the SURFACE.

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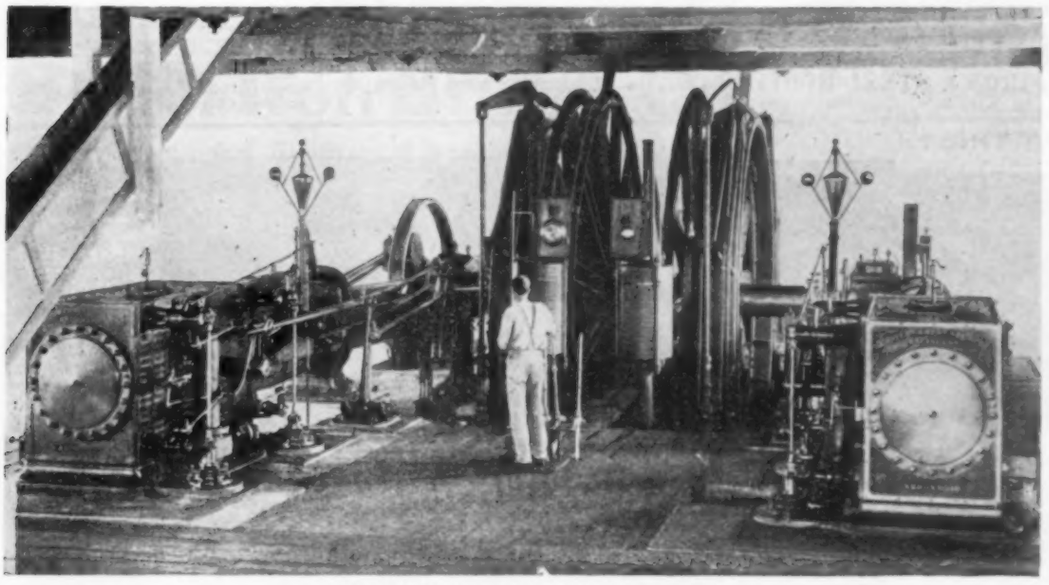

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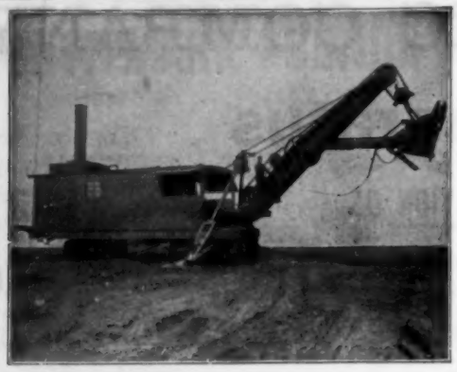

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WRECKING CRANES	Hand or Steam, 5 to 35 tons capacity. Also Locomotive Cranes and Pile-Drivers.
CENTRIFUGAL DREDGING PUMPS	6-inch to 36-inch. With either simple compound or triple engines.

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For Softness, Strength, Fluidity, Durability,

OVER OTHERS.

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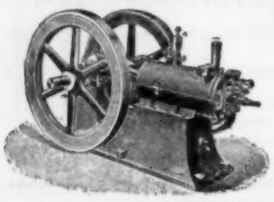
Furnaces: Pittsburg, Pa. New York Office. No. 15 Cortlandt Street.



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* Daily. † Daily, except Sunday.

FROM CLEVELAND TO	LEAVE	ARRIVE
Pittsburgh and Bellaire	† 7:00 am	†12:10 pm
Salem and Pittsburg	* 8:00 am	* 8:30 pm
Pittsburgh, Bellaire and East	† 3:30 pm	† 6:25 pm
Philadelphia and New York	* 1:40 pm	*11:25 am
Baltimore and Washington	* 1:40 pm	*11:25 am
Alliance and Pittsburgh	* 1:40 pm	*11:25 am
Ravenna and Alliance	* 5:00 pm	* 8:30 am
Philadelphia and New York	*11:10 pm	* 4:30 am
Baltimore and Washington	*11:10 pm	* 4:30 am
Alliance and Pittsburgh	*11:10 pm	* 4:30 am

Mt. Vernon and Pan-Handle Route

FROM CLEVELAND TO	LEAVE	ARRIVE
Xenia and Cincinnati	* 8:10 am	* 5:45 pm
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The Cleveland Terminal & Valley R. R. Co.

Depot foot of So. Water St.
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	Arrive.	Depart.
Valley Jctn. & Way Stations	*6:30 P M	*7:10 A M
Akron, Canton & Valley	*10:10 A M	*3:15 P M
Akron, Canton & Chicago	*8:10 A M	*6:30 P M
Akron, Canton & Wooster, Defiance, Garrett, Marietta, Wheeling, Washington, D. C., and Baltimore	†2:55 P M	†11:00 A M

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Sample piece of FLUE taken from Locomotive No. 725 running for 7 months on Western Division of N. Y. C. & H. R. R. R. showing amount of SCALE adhering in that time.

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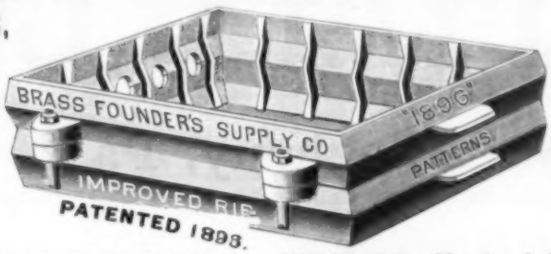

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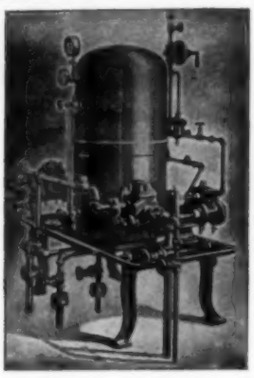

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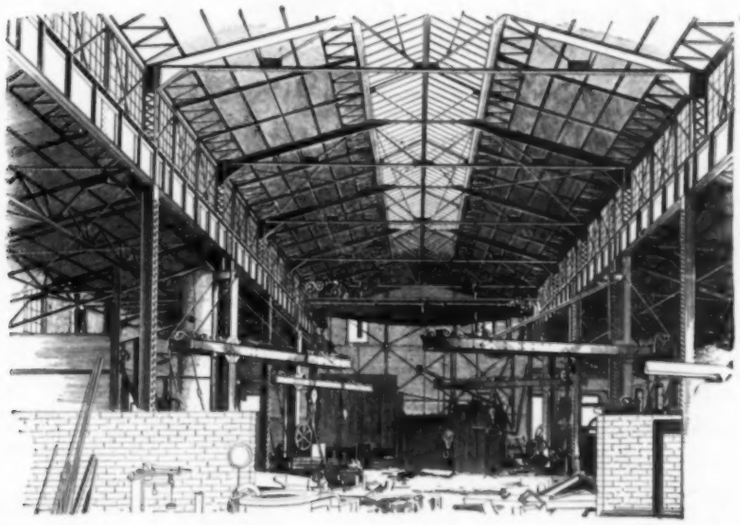
THE Berlin Iron Bridge Co.

Engineers, Architects and Builders of Iron and Steel Structures.



The above illustration is taken direct from a photograph and shows the interior of a Foundry Building, which was designed and built by us for the S. F. Hodge & Co., at Detroit Mich. Each wing is 24 ft. in width and the central portion is 40 ft. in width, this latter controlled by a Crane with a travel the full length of the building. The crane girder posts are designed to carry jib posts as shown. The roof is covered with our Patent Anti-Condensation Corrugated Iron. The building is absolutely fire-proof, and the corrugated iron is guarnteed not to drip during the coldest weather.

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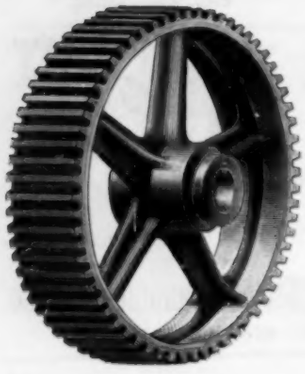

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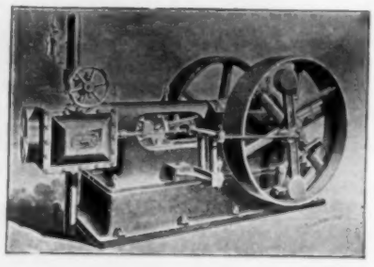

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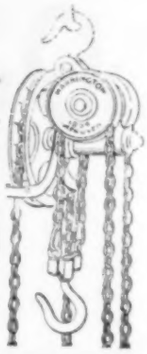

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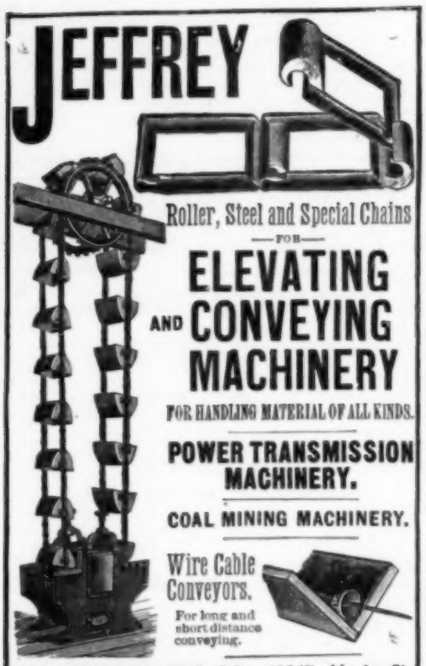

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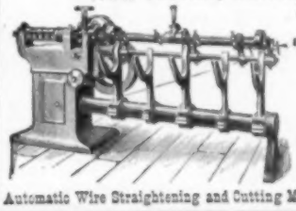

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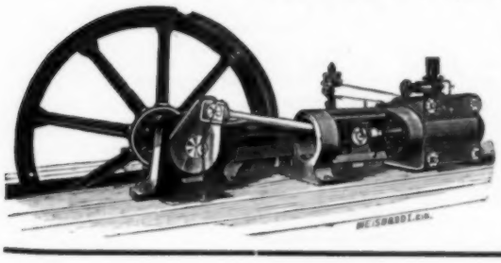

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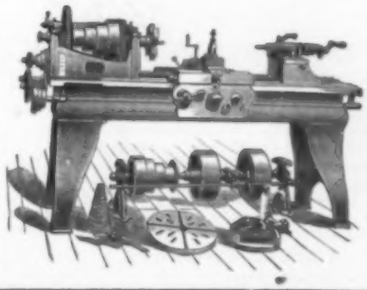

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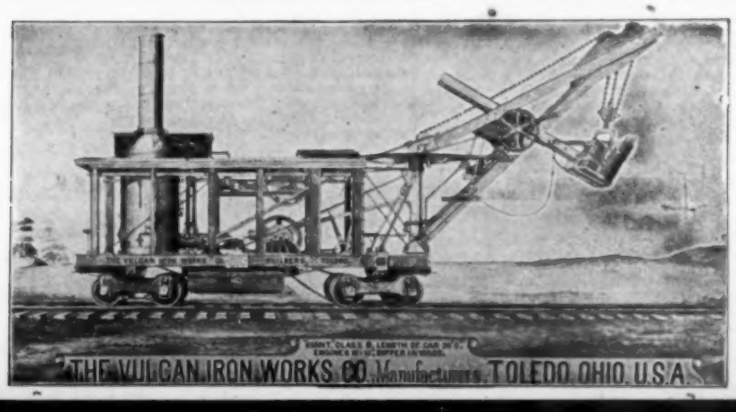

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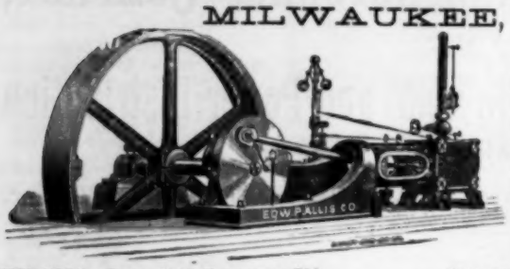

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Toledo Machine & Tool Co.	37
*Trethewey & Co	—
Translucent Fabric Co.	25
Union Mining Co.	18
Upson Nut Co.	1-2
*Vulcan Iron Works, Toledo	29
Westinghouse Electric & Mfg. Co.	31
*Williams Mfg. Co.	—
Westmoreland Fire Brick Co.	33
Worthington, Henry R.	21
Wright Co.	29
Wellman Seaver Engineering Co.	38

IRON AND STEEL MARKETS.

IRON ORE.

[On Lake Erie docks.]

No. 1 Specular, Bessemer	$4.50@ 4.75
No. 1 Bessemer hematite	4.00@ 4.25
Hematites No. 1 non-Bessemer	2.25@ 2.50
No 1. Specular, non-Bessemer	2.75@ 3.00

PIG IRON.

CLEVELAND (f. o. b. cars):

Bessemer	$11 50@ 11 75
No. 1 Strong Foundry	11 75@ 12 00
No. 2 Strong Foundry	11 25@ 11 50
No. 1 Gray Forge, red short	10 00
No. 2 Gray Forge, neutral	9 75
No. 1 American Scotch	11 75
No. 2 American Scotch	11 25
Lake Superior Charcoal	13 50

PITTSBURG:

No. 1 Foundry	$11 50@ 11 75
No. 2 Foundry	11 00@ 11 25
Gray Forge	9 75@ 10 00
White and Mottled	9 50
Warm Blast Charcoal	15 00@ 16 00
Cold Blast Charcoal	20 00
Bessemer	11 50@ 11 75

CHICAGO:

Lake Superior Charcoal	$13 50@$14 00
Local Coke Foundry No. 1	12 00@ 12 50
Local Coke Foundry No. 2	11 50@ 12 00
Local Coke Foundry No. 3	11 00@ 11 50
Local Scotch Foundry No. 1	12 00@ 12 50
Local Scotch Foundry No. 2	11 50@ 12 00
Local Scotch Foundry No. 3	11 00@ 11 50
Southern Coke No. 1	12 10@ 12 35
Southern Coke No. 2	11 60@ 11 85
Southern Coke No. 3	11 10@ 11 60
Southern No. 1 Soft	11 60@ 11 85
Southern No. 2 Soft	11 35@ 11 50
Southern Silveries No. 1	11 85@ 12 35
Southern Silveries No. 2	11 60@ 11 85
Jackson Co. Silveries	14 50@ 16 00
Ohio Silveries No. 1	15 00@ 15 50
Ohio Silveries No. 2	14 50@ 15 00
Ohio Strong Softeners	15 00@ 15 50
Alabama Car Wheel	16 85@ 17 35
Malleable Bessemer	13 00@ 13 50
Coke Bessemer	13 00@ 13 50

CINCINNATI (reported by Rogers, Brown & Co.)

Southern Coke No. 1, Foundry	$ ... $10 00
Southern Coke No. 2 and No. 1 Soft	9 50
Hanging Rock Coke, No 1	12 50@ 13 50
Hanging Rock Charcoal No. 1, Fdy	16 00@ 17 00
Tennessee Charcoal No 1	13 00@ 14 00
Jackson County Silvery No 1	14 00@ 14 50
Southern Coke, Gray Forge	8 25
" " Mottled	8 25
Standard Alabama Car Wheel	15 00@ 16 00
Tennessee " "	14 00@ 15 00
Lake Superior " "	15 25@ 15 50

BUFFALO:

No. 1 Foundry Strong Coke Iron Lake Superior Ore	$12 00@12 25
No. 2 Foundry Strong Coke Iron Lake Superior Ore	11 50@ 11 75
Ohio Strong Softener No. 1	12 00@ 12 50
Jackson Co. Silvery No. 1	14 25@ 14 50
Lake Superior Charcoal	13 50@ 14 00
Southern Soft No. 1	12 15
Hanging Rock Charcoal	17 00

ST. LOUIS (reported by Rogers, Brown & Mencham):

Southern Coke No 1	$ ...$11 50
Southern Coke No. 2	11 00
Southern Coke No. 3	10 50
Southern Gray Forge	10 00
Southern Charcoal No. 1	15 00
Missouri Charcoal No. 1	14 00@ 15 00
Ohio Softeners	16 00
Lake Superior Car Wheel	15 00
Southern Car Wheel	16 25

OLD RAILS AND SCRAP METAL.

	Gross Tons
Old iron rails	$15 00
Old steel rails	12 00
Old car wheels	12 50
	Net Tons
No. 1 R. R. wrought scrap	$11 00
Mill scrap	8 00
No. 1 Machine cast scrap	9 00
Iron axles	16 00
Axle turnings	7 50
Wrought turnings (free from cast)	7 00
Cast borings	5 00
Uncut wrought iron boilers	4 00
Steel boiler plates	8 00
Grate bars	5 00
Pipes and flues (clean)	8 00
Tank iron	8 00
Hoop and band iron	5 50
Sheet iron	5 00
Wrought drillings	6 00
Malleable iron	8 50

STRUCTURAL MATERIAL.

Beams and Channels (Cleveland mill)	1.65c
Angles	1.29c
Tees	1.50c
Universal Plates	1.30@1.35c
Sheared Plates	1.40c

MERCHANT IRON AND STEEL.

[List prices out of store.]

Flat Bar.

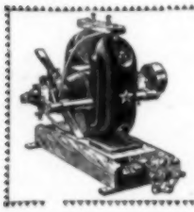
1½ to 4 by ⅜ to 1 inch	1 30
4¼ to 6 by ⅜ to 1 inch	1 35
1½ to 6 by 1¼ to 2 inch	1 35
1¼ & 1⅜ by ⅜ to ¾ inch	1 20
1 & 1¼ by ⅜ to ¾ inch	1 20
⅛, ¼, ⅜, by ⅜ to ¾ inch	1 20

Frank P. Cady, Pres. and Supt.
Geo. H. Bowler, Sec'y and Treas
THE CADY MFG. CO.
18, 20 and 22 Johnson St., CLEVELAND, O.

SEND FOR OUR NEW CATALOGUE OF Power Presses, Drop Hammers, Punches and Shears, Wire Working and Special Machinery.

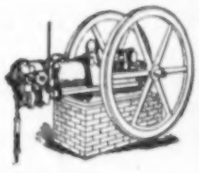
PERFORATED METALS
OF ALL KINDS FOR
MILLING MINING AND AGRICULTURAL MACHINERY,
PERFORATED IRON, STEEL, COPPER, BRASS, TIN, ZINC, LEAD, ETC., TO ORDER.
LARGE AND VARIED ASSORTMENT OF SIZES. CORRESPONDENCE SOLICITED.
THE ROBERT AITCHISON. PERFORATED METAL CO.,
OFFICE, ROOM 510 265 TO 269 DEARBORN STREET, CHICAGO, ILL. WORKS SOUTH CHICAGO.

A. H. LEITCH, PRES'T. JOHN C. LEITCH, SEC. AND TREAS.
WESTMORELAND FIRE BRICK CO.
MANUFACTURERS OF HIGH GRADE **FIRE BRICKS.**
PITTSBURG, PA.
Works and Mines, Westmoreland, Pa.



SMALL DYNAMOS
For Incandescent Lighting,
In Factories, Mills, etc., at a Reasonable Price.
If you have power put in your own lighting plant. Write for our Catalogue.
STAR DYNAMO CO., Jefferson City, Mo.

POWER From **GAS OR GASOLINE.**
No Steam, Coal, Ash, Gauges, Engineer nor Danger.
From 1 to 250 horse-power. } **Can be Used in City or Country.**
THE OTTO GAS ENGINE WORKS, Inc.
33d and Walnut Sts., PHILADELPHIA, PA.
S. M. York, 42 S. Water St., Cleveland Agent. Over 45,000 Sold.



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IRON CLAD PAINT CO.
Factory, 75 & 77 Central Way. Sec. & Treas., No. 3 Case Build'g.
CLEVELAND OHIO.

ORDER DIRECT FROM THE
Iron Clad Paint Co.
And get the genuine article, and save liability of suit for using an article made in violation of the patents issued to Wm. Green, and now owned by this Company.
IRON CLAD PAINT is the most durable, most fire-proof and Cheapest Paint made.
FURNISHED both Dry and Ground in Oil
USED BY NEARLY ALL THE RAILROADS.

Round and Square.

1 to 1⅞ inch	1 10
2 to 2⅜ inch	1 30
2⅜ to 3¾ inch	1 25
3⅜ to 4 inch	1 60
4⅛ to 4⅜ inch	2 20
4⅜ to 5 inch	2 40

Oval.

⅜ to 1¼ inch	1 30
½ to ¾ inch	1 30
⅝	1 50
¾	1 70

Half Oval and Half Round.

1⅛ to 3 inch	1 65
⅜ to 1⅛ inch	1 45
½ to ¾ inch	1 70
⅞	1 85
1	2 90

Heavy Band.

1¼ to 6 by ¼ and 5-16 inch	1 20
1 to 1¾ by ¼ and 5-16 inch	1 25
¾ to ⅞ by ¼ and 5-16 inch	1 35
⅛ to ⅜ by ¼ and 5-16 inch	1 60

Hoop Iron.

1 7-16 to 4, No. 13, 14, 15 and 16	1 35
1 7-16 to 2, No. 17, 18 and 19	1 40
1 7-16 to 2, No. 20	1 50
1 7-16 to 2, No. 21	1 62
1 7-16 to 2, No. 22	1 70
1⅛ to 1⅜, No. 13, 14 and 15	1 40
1⅛ to 1⅜, No. 16, 17 and 18	1 45
1⅛ to 1⅜, No 19 and 20	1 50
1⅛ to 1⅜, No. 21	1 60
1⅛ to 1⅜, No. 22	1 70
15-16 and 1 inch, No. 13, 14 and 15	1 35
15-16 and 1 inch, No. 16, 17 and 18	1 50
15-16 and 1 inch, No. 19 and 20	1 60
15-16 and 1 inch, No. 21	1 70
15-16 and 1 inch, No. 22	1 85
⅝, No. 13, 14 and 15	1 60
⅝, No. 16, 17 and 18	1 70
⅝, No. 19 and 20	1 80
⅝, No. 21	1 90
⅝, No. 22	2 00
13-16, No. 13, 14 and 15	1 70
13-16, No. 16, 17 and 18	1 80
13-16, No. 19 and 20	1 90
13-16, No. 21	2 00
13-16, No. 22	2 10
¾, No. 13, 14 and 15	1 80
¾, No. 16, 17 and 18	1 95
¾, No. 19 and 20	2 05
¾, No. 21	2 15
¾, No. 22	2 25
11-16, No. 13, 14 and 15	2 05
11-16, No. 16, 17 and 18	2 10
11-16, No. 19 and 20	2 20
1-16, No. 21	2 30
11-16, No. 22	2 40
11-16, No. 23	2 50
⅞, No. 13, and 15	2 10
⅞, No. 16, 17 and 18	2 20
⅞, No. 19 and 20	2 30
⅞, No. 21	2 40
⅞, No. 22	2 50
⅞, No. 23	2 60
9-16, No. 13, 14 and 15	2 30
9-16, No. 16, 17 and 18	2 40
9-16, No. and 20	3 50
9-16, No. and	1 60
9-16, No. 221	2 70
9-16, No. 22	1 80
7-16 and ⅛ inch, No. 13, 14 and 15	3 50
7-16 and ⅛ inch, No. 16, 17 and 18	2 60
7-16 and ⅛ inch, No. 19 and 20	2 70
7-16 and ⅛ inch, No. 21	2 80
7-16 and ⅛ inch, No. 22	2 90
7-16 and ⅛ inch, No. 23	3 00
⅜, No. 13, 14 and 15	3 00
⅜, No. 16, 17 and 18	3 10
⅜, No. 19 and 20	3 20
⅜, No. 21	4 50
⅜, No. 22	3 00
⅜, No. 23	3 75

Light Band.

1⅜ to 6 by ⅛ to 3-16 inch	1 60
1⅜ to 6 by Nos. 11 and 12	1 65
1 to 1¾ by ⅛ to 3-16 inch	1 65
1 to 1¾ by Nos. 11 and 12	1
⅜ and 13-16 by ⅛ to 3-16 inch	1
⅜ and 13-16 by Nos. 11 and 12	1 75
¼ and 11-16 by ⅛ to 3-16 inch	1 90
¼ and 11-16 by Nos. 11 and 12	1 95
⅛ and 9-16 by ⅛ to 3-16 inch	2 05
⅛ and 9-16 by Nos. 11 and 12	2 10
⅛ by ⅜ to 3-16 inch	2 20
¼ by Nos. 11 and 12	2 25

Wagon Box Iron.

⅜ inch, beveled edge, by Nos. 11 and 12	1 50
⅜ inch, " " " " 13 and 14	1 60
½ inch, " " " " 11 and 12	1 65
½ inch, " " " " 13 and 14	1 75

Sheet Iron.

No. 10	1 45
No. 12	1 55
No. 14	1 65
No. 15-17	1 75
No. 18	1 90
No. 20	2 05
No. 22-24	2 15
No. 25 26	2 25
No. 27	2 35

Steel Boiler Plates—1-4 in. and Heavier.

Tank	1 45
Shell	1 60
Flange	1 70
Marine Flange	2 00
Fire Box	2 50

Above includes plates 90 inches wide.

90 to 96 in. wide	¼c. lb. extra
96 to 100 in. wide	1 c. "
100 to 104 in. wide	1¼c. "
104 to 106 in. wide	special

American Cast Tool Steel.

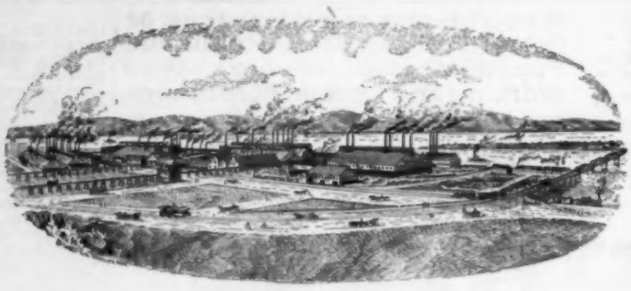
ROUND, SQUARE AND OCTAGON.	cts. lbs.
1 to 2 in, inclusive	08
9-16 to ⅞ in. "	08

Soft Steel Bars, Light

LOW PRICES

do not always influence business. Some brands of goods are undesirable as a **Gift.**

Write us for our catalogue and send us a sample order and see if there is not **Economy** in using **First Quality** goods at Fair Prices.



Structural Shapes, Rails.

TIN PLATES,
GALVANIZED SHEETS,
CORRUGATED IRON,
BLACK PLATES,

Sheet Iron and Steel, any finish, patent leveled or common.

Aetna Standard Iron & Steel Co.,
BRIDGEPORT, OHIO.

ROBERTS STEEL CHAIN BELTING CO., Pittsburg, Pa.

Elevating and Conveying Machinery

For Handling all kinds of materials.

Special Wrought and Steel Chains of every description; Coil and Cable Chains; Chain Haulages for Coal Mines; Sprocket Wheels; Complete Coal and Ashes Handling Plants; Wire Rope Haulages and Wire Rope.

W. H. COFFMAN COKE CO.

BLUEFIELD, W. VA.

GENERAL FACTORS AND SHIPPERS OF

POCAHONTAS FLAT-TOP COKE.

So low in ash that it requires no fluxing for foundry purposes. Our foundry and furnace coke was awarded the first premium at the World's Fair in 1893.

AVERAGE ANALYSIS OF COKE.

Moisture	00.196	Sulphur	00.677
Fixed Carbon	93.625	Ash	05.004
Volatile Matter	00.494		

Foundry, Furnace and all sizes of crushed coke. Guaranteed lower in Sulphur than any other commercial coke

STEEL CASTINGS

FROM 10 LBS. UPWARD.

Made from Best Open-Hearth Steel.

ALSO SAND ROLLS AND CAST-IRON PINIONS.

SEND FOR ESTIMATES.

THE JOHNSON COMPANY, Johnstown, Pa.

FRASER & CHALMERS
Chicago, Ill., U. S. A.
Engines and Steam Plant,
ALSO
CAST STEEL CUT GEARS
Much Superior to Cast Iron.
MAKERS OF
John Walker's Differential Cable Drums.

7-16 to ⅜ and 2⅜ to 3 in.	.09
3⅜ to 4 in.	.09½
⅜ to 11-16 and 4⅛	.10
⅝ to 6 in.	.10¼
¾ to 9-32 and 6⅝ to 7 in.	.11
7 ⅛ in	.13

Flats.

	cts. lbs.
2 to 9-16 in. wide by 2 to ⅜ thick	.8

Bessemer and O. H. Steel.

Bessemer Machinery	base price,	1 50
Open-hearth Tire	"	1 50
Open-hearth Spring	"	1 70
Sleigh Shoe	"	1 55
Toe Calk	"	1 65
Cutter Shoes, tapered and bent	"	1 70

English Tool Steel.

Jessop's	15½c
Hobson's "Best"	15½c
" "Choice"	35c

Burden Boiler Rivets.

½, ⅝, 11-16 and ¾ inches diameter	3 30
Bridge ½, ⅝, 11-16 and ¾ inch diam	3 00

Wrought Pipe and Boiler Tubes.

Lap weld black, base	dis. 65
Butt " " "	dis.
Lap " galv. "	dis. 57½
Butt " " "	dis. 50
Boiler tubes 2¼" and smaller	dis 62½
Boiler tubes 2½" and larger	dis. 65
Casing screw and socket joint	dis. 52½
Casing inserted joint	dis. 47½

MACHINERY SUPPLY MARKET.

Anvils.

American	℔ lb 9@10
Wright's	℔ lb 12

Bellows.

Blacksmiths'	Hill's dis 40
	Bullock's dis 50&10
Moulders'	dis 40@40&10
Hand	dis 40&10@50

Belting.

Boston Belting Co.'s standard	dis 70 & 10
" " " extra	dis 60&10
" " " best	dis 55
Cleveland Rubber Co. extra standard	dis 60&10
Hoyt's Short Lap	dis 50
Shultz Raw Hide Leather Belting, single	dis 40
Munson's Short Lap Single Leather	dis 50
Munson's Short Lap Double and Light Double Leather	dis 50&10
Shultz Raw Hide Leather Belting, Double and Light Double	dis 40
Standard, oak tanned	dis 50&10
Alexander Brothers' pure oak tanned	dis

Blowers and Exhausters.

B. F. Sturtevant's	dis 20
Boston Blower Co.	dis 35

Chucks.

Cushman's 4 Jaw Independent	dis 45
" Combination	dis 40
" Geared Scroll	dis 30
" 2 Jaw Brass Workers	dis 30
" Drill	dis 35
Wescott's Scroll Combination	dis 33⅓
" Independent	dis 40
" Little Giant Drill	dis
Horton's Universal	dis
" Independent	dis 45
Whiton's Independent	dis 45
National Combination	dis 40
Sweetland "	dis 40
Almond Drill	dis 20
Morse "	dis 15
Skinner's Combination Lathe	dis 40&10
" Independent Lathe	dis 40&10
" Universal Lathe	dis 40&10
" Drill	dis 30

Cutters and Reamers.

Cleveland	dis 10@15
Pratt & Whitney	dis 10@15
Standard	dis 10@15
Morse	dis 15
Brown & Sharpe, Milling Cutters	dis
" " Gear Cutters	dis

Crowbars.

Cast Steel	℔ 3½
Iron, steel points	℔ lb 3

Drill and Drill Sockets.

Twist Drills	dis 60&10
Morse Taper and Straight Shank to 1½"	dis 60&10
Morse Taper and Straight Shank Larger than 1½"	dis 25
Drill Sockets	dis 25
Standard Twist Drills	dis 60@60&5
Cleveland " "	dis 60@60&5

SHIFFLER BRIDGE COMPANY,

BUILDING DEPARTMENT.

SPECIALTIES: STEEL AND IRON BUILDINGS FOR ROLLING-MILLS TIN PLATE PLANTS, STEEL WORKS, FOUNDRIES, FACTORIES, ROOF TRUSSES, GIRDERS, COLUMNS, BEAMS, CORRUGATED IRON, ETC.

Main Office and Works:
48th Street and A. V. Ry.
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Branch Offices:
1123 Betz Building, Philadelphia, Pa.
65 Dexter Building, Chicago, Ill.
228 Lumber Exchange, Minneapolis, Minn.

CAMBRIA STEEL.

Steel Rails, Blooms, Billets, Bars, Axles, Angles, Channels, Forgings, Locomotive Car and Structural Steel.

CAMBRIA IRON COMPANY, S. W. Cor. 15th and Market Sts., opp. Penna. R. R. Station, Philadelphia; Chicago office, Western Union Building; New York office, (for Rails and Axles), 33 Wall St.; Cleveland office, Bourne, Fuller & Co; Detroit office, Newberry Bldg.; Toledo office, The Nasby, No. 401; Cincinnati office, cor. Elm and Pearl Sts. Works at Johnstown, Pa.

GAUTIER STEEL DEPARTMENT OF CAMBRIA IRON CO.,

JOHNSTOWN, PA.

MERCHANT BAR STEEL: Including Tire, Toe Calk, Machinery, Carriage Spring, Railroad Spring, Hoe, Rake, Fork, etc.
AGRICULTURAL STEEL AND SHAPES: Finger Bars, Knife Backs, Rake Teeth, Bundle Carrier Teeth, Tedder Forks and Springs, Spring Harrow Teeth, Harrow (Drag) Teeth, Seat Springs, etc.
PLOW STEEL: Flat and Finished Plow Shapes, Digger Blades, Slabs (Penn and Perrot), Hammered Lay, Rolled Lay, etc.

Cold Rolled Steel Shafting. **Steel Harrow Discs.** **Cambria Link Barb Wire.**

New York Office, 102 Chambers St. | Philadelphia Office, 611 Phila. Bourse. | Chicago Office, 209 Western Union Bldg. | Atlanta Office, 325 Decatur st.

STUART FIRE BRICK CO.

MANUFACTURERS OF

Silica Brick

For Open-Hearth, Basic and Acid Steel Furnaces, Glass and Copper Tank Furnaces. Extra Shapes MADE TO ORDER.

Office, Room 21, Conestoga Bldg., Cor. Wood and Water Sts., PITTSBURG, PA.

The Best Flux known for Welding

IRON TO IRON. Cherry Heat Welding Compound. STEEL TO STEEL. Manufactured in NEW YORK CITY.

AND

Malleable Iron to Steel.

IMPORTER AND JOBBER OF
PURE REFINED BORAX.

—ONLY—

Welding Compound

AWARDED MEDAL AND DIPLOMA AT WORLD'S FAIR, CHICAGO.

One Pound Tin Mailed on Receipt of 30c.
SEND FOR CIRCULAR AND PRICE LIST.

MANUFACTURED ONLY BY

CORNELIUS S. MITCHILL,
Office and Factory,
545-549 W. 22nd St., NEW YORK, N. Y.

We Claim The Following Merits for Jenkins Bros.' Valves

1. Manufactured of the best Steam Metal.
2. No regrinding, therefore not constantly wearing out the Seat of the Valves.
3. Contain JENKINS DISC, which is suitable for all Pressures of Steam, Oil and Acids.
4. The Easiest Repaired, and all parts Interchangeable.
5. Every Valve Tested before leaving the factory.
6. ALL GENUINE stamped with Trade Mark,

(2)

JENKINS BROTHERS, NEW YORK, PHILADELPHIA, CHICAGO, BOSTON.

Emery.

	No. 4 to 46 gr.	No. 54 to 150 gr.	Flour, F. F.
Kegs, 100 lb	4½c	5 c	2½c
½ kegs 50 lb	4¾c	5¼c	2¾c
¼ kegs 25 lb	5 c	5¼c	3 c
10 lb cans, 10 in case	6 c	6¼c	5 c
10 lb cans less than 10..10	c	10 c	7½c

Emery Cloth and Paper.

Barder, Adamson & Co. ..... dis 50@50&5
H. H. Barton ..... dis 50@50&5

Emery Wheels.

Detroit ..... dis 60@70
Norton's ..... dis 60@70
Grant ..... dis 60@70
Sterling ..... dis 60@70
Celluloid ..... dis 10&33⅓
Northampton ..... dis 50
Crystal ..... dis 65@70
Vitrified ..... dis 60@70
Vulcanite ..... dis 60&10
Hamden ..... dis 60&10@75
Cyclone ..... dis 60@60&10

Files.

Arcade ..... dis 60&10@60&10&10
Nicholson ..... dis 60&10@60&10&10
" X. F. ..... dis 25
Kearney & Foot ..... dis 60&10@60&10&10
Black Diamond ..... dis 60&10@60&10&10
McClellan ..... dis 60&10@60&10&10
Disston's ..... dis 65@70
Western ..... dis 70
Stub's ..... dis 25
Grobet's ..... dis 30
Reynolds Bros.' Hand Cut ..... dis 50
Industry File Works Hand Cut ..... dis 50

Hammers.

P. S. W ..... dis 40
Atha new list, Jan. 15, 1897 ..... dis 50
Heavy hammers and sledges under 5 lbs 12c
" " " " over 5 lbs 10c

Jack Screws.

Illinois Bolt Co. list ..... dis 75

Nuts and Washers.

Size of bolt inches	¼	5-16	⅜	½	⅝	¾	1
Square	8	7	5½	4¾	4	3½	3⅛
Hexagon	13½	11¼	8½	6	5¼	5¼	
Washers	9	8	7	5	4½	4½	4½

In lots less than 100 lbs, ⅛ lb add ½c., 1 lb boxes add 1c to list.

Nails (wire).

Standard Penny Nails, 100 keg card rate
{ Car lots $2.55
{ Less than car lots $2.65

Oilers.

Zinc and Tin ..... dis 60
Brass and Copper ..... dis 50
Malleable (Hammer's), No. 1, $3.60; No. 2, $4.00; No. 3, $4.40 ⅛ doz ..... dis 10@10&10

Picks.

Railroads, 5 to 6 lbs ..... $12 dis 60
" 6 to 7 lbs ..... $13 dis 60

Pulleys.

Iron Pulleys, Walker List ..... dis 50
Medart Pulleys ..... dis 50
Split Wood Pulleys ..... dis 55@60

Pulley Blocks.

Moore's Anti-Friction Differential Chain Pulley Block ..... dis 20

Rivets.

Iron, Thousand, list November 1, 1894 ..... dis 60@65
Iron, Ordinary, Cooper's Block and Carriage list November 1, 1894 ..... dis 60@65
Copper ..... dis 50@50&10

Taps.

Cards, Hand and Nut to 2 in ..... dis 50
Carpenters' " " " ..... dis 50
Morse " " " ..... dis 50
Pratt & Whitney " " new list ..... dis 10
Machine Screw Taps ..... dis 55
Pipe Taps to 2½ in ..... dis 70
Stay Bolt Taps ..... dis 25
Stove Bolt Taps ..... dis 55
Pulley Taps ..... dis 40

Vises.

Solid Box ..... dis 60
Parker's ..... dis 20@25
Prentiss ..... dis 20
Stephen's ..... dis 25@30
Barrett's ..... dis 30
Miller's Falls ..... dis 40
Merrill's ..... dis 15@20
Howard ..... dis 35

Wire.

New List, Apr. 9, 1894

Brass ..... dis 40
Copper ..... dis 40
Bright and annealed, Nos. 0@18 ..... dis 70&10@75
" " Nos. 19@26 ..... dis 75@75&5
" " Nos. 27@36 ..... dis 75&10&5
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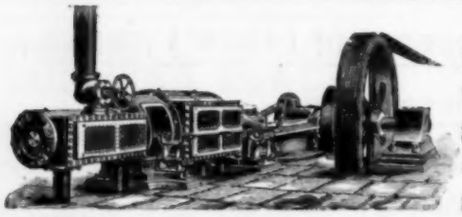

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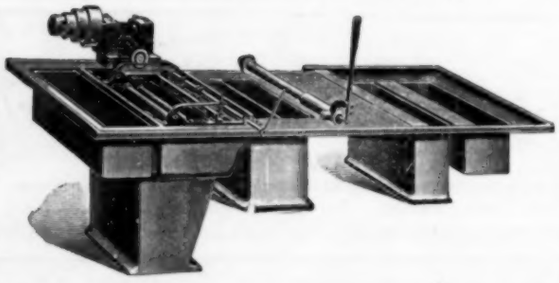

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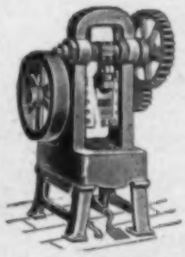

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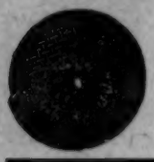

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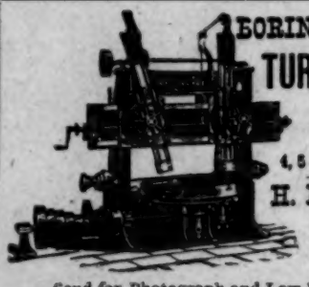

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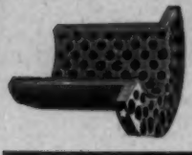

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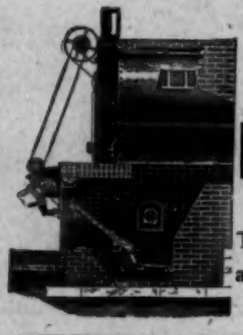

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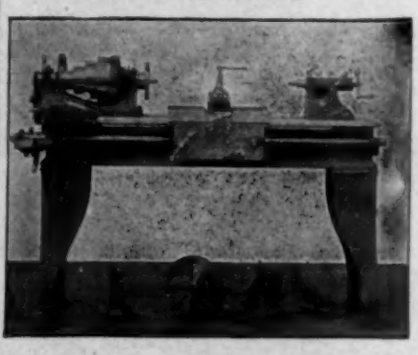

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